SCIENTIFIC AMERICAN

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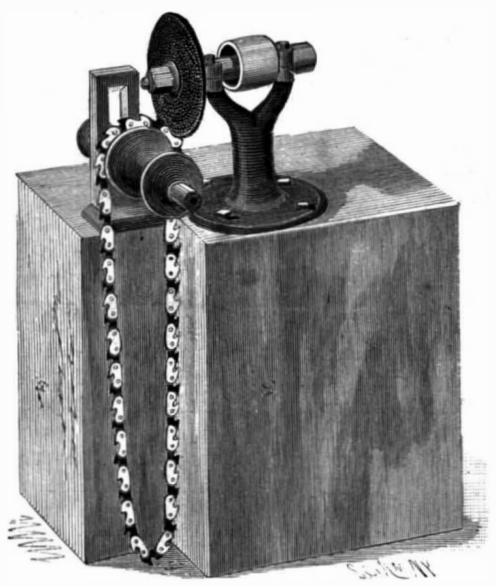
THE CHAIN SAW MORTISER.

No branch of mechanics has received greater development in the United States than that which relates to woodworking. America has been pre-eminently a wood-producing country, and has brought shaping, planing and sawing machinery into the greatest perfection. Soon after its introduction the apparently weak band saw was developed so as to cut the hardest wood of any thickness with accuracy, economy and convenience undreamt of. We illustrate in our present issue a machine which has aptly been said to be an invention as revolutionary as that of the band saw. It is known as the chain saw mortiser.

In indoor woodwork especially, an immense quantity of mortise and tenon work has to be done, and machines for the purpose have been used for many years. The mortising machines have been constructed on the general principles of the old hand chisel and auger, representing in their operation the processes of the human operative. These machines the chain mortiser replaces, throwing into disuse the old chiseling processes, and substituting therefor a cutting tool which eats its way into the heart of the hardest or softest wood with the utmost rapidity, making therein a mortise of mathematical accuracy of shape, clearing it of even the smallest chip and leaving no core to be knocked out. This work it does silently; the old chisel mortiser in full operation was a most disagreeable machine in the shop, while the chain mortiser works almost in silence.

The chips which it makes are by its own action brought opposite to the suction orifice of a rotary blower, by which they are blown away, making it one of the cleanest machines which can be used in the shop.

The soul of the machine is in its chain, which, with its sprocket and feeder bar, we illustrate in one of our cuts. The chain is an endless one, somewhat similar to a bicycle chain, but with links toothed on the outside. The links may be divided into three kinds, arranged in succession as shown in the small cut; some



CHAIN SAW SHARPENING MACHINE.

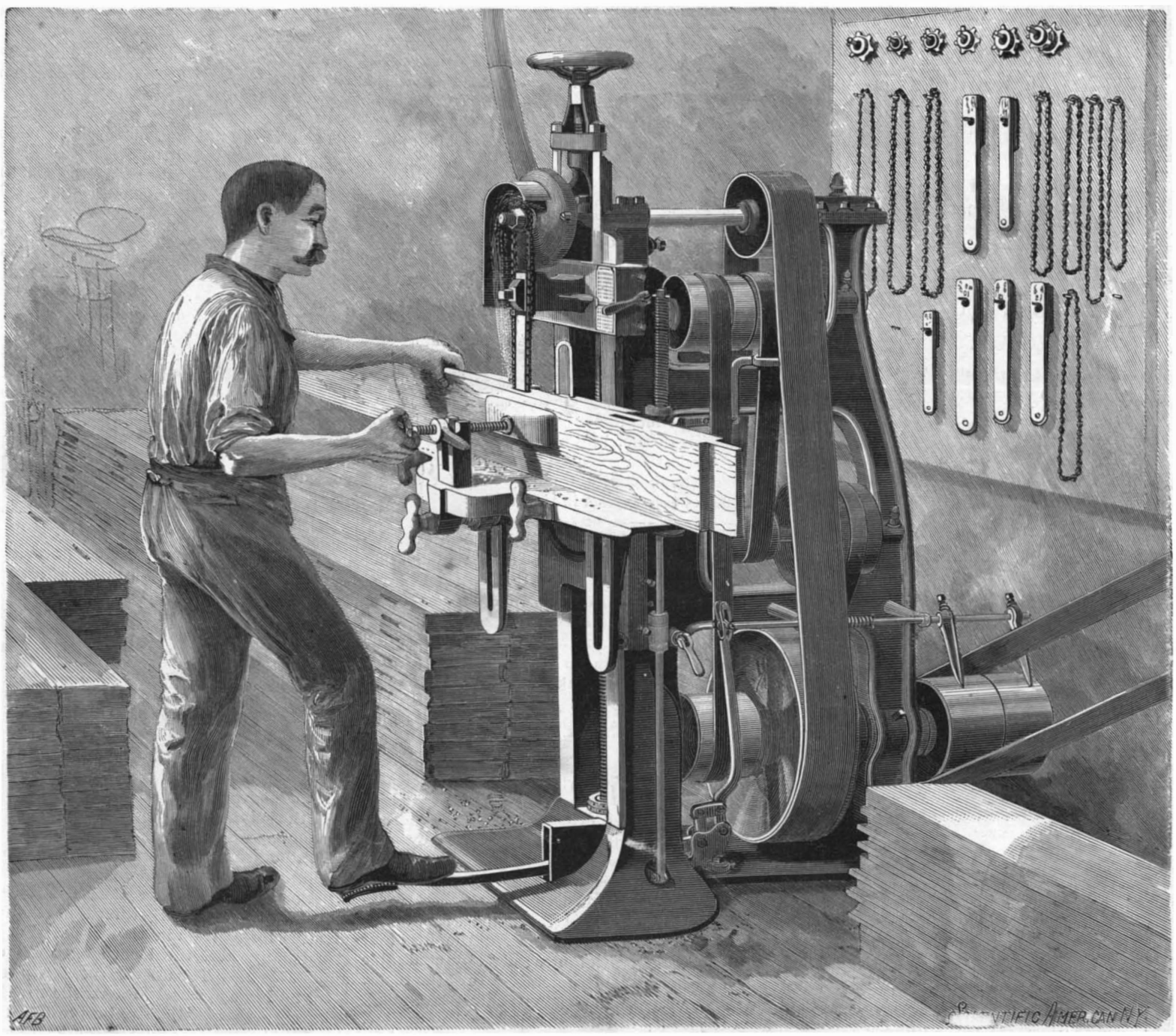
with two outside teeth and a clearance space between, others with two intermediate spaces with clearance spaces outside and between, others with a single central tooth. The chain is rotated from a sprocket wheel at its upper end, as shown in the cut, while it is brought to a proper state of tension by the feeder bar which is seen at its lower portion. A wheel rotating on accurate roller joints is carried by the lower end of the feeder bar. The right hand figure shows this roller with the journal cover plate removed.

It is obvious that, if the chain is rotated in the proper direction, the edges of the teeth will cut their way through a piece of wood. In the machine the chain is mounted on the front. Beneath it is a working table on which the work is placed and clamped. By the action of the machine the face of the work is brought up against the chain so as to effect the mortising. The chain rotates with high velocity, and a deep mortise is made in the hardest wood, complete and ready for gluing in one or two seconds.

The machine is carried on a large substantial base, on which a compact frame is supported, which carries the necessary band wheels and feed mechanism. When in action, the chain is kept constantly in rapid motion, its speed varying from 1,800 to 2,300 feet a minute, and its feeder bar projecting down over the work table. The work table on its front is adapted to be placed at different angles, so that the mortises can be made in any desired direction. From the front of the base projects a foot lever, by which the belts are shifted back and forth, a very ingenious arragement of parallel motion levers being employed at the inner end of the footlever. At the right side of the frame rises a spindle, with two adjustable collars.

As the machine is automatic in its motion, the upper collar is applied to regulate the depth of the mortise and its position determines the rise of the table. The work being put in position and clamped, a

(Continued on page 356.)



THE CHAIN SAW MORTISER.

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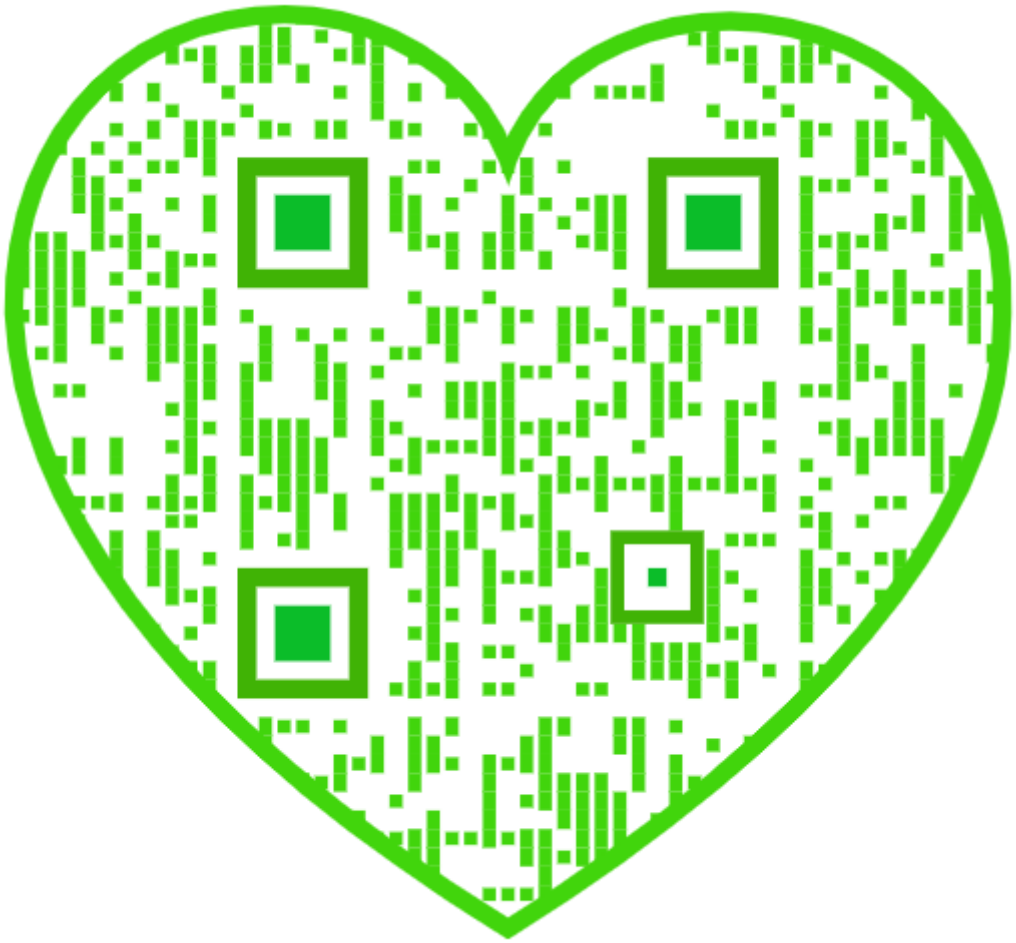

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IMPROVEMENT OF BOSTON HARBOR.

A movement is on foot to procure from Congress the necessary appropriations for the deepening of the channels at Boston, so as to admit vessels of the largest class. A depth of 30 feet is necessary, while at present only from 23 to 27 feet at mean low water are available. Boston is now one of our most important shipping ports and enjoys a great and growing commerce. There should be no delay in granting the most liberal appropriations for a work at once so necessary and advantageous to the whole country.

THE UTILIZATION OF WIND AS A MOTIVE FORCE.

For many centuries wind has been used in the countries of the old world as a motive power. In some of the low lying lands of Central Europe the lumbering old windmill is still one of the characteristic features of the landscape.

In this country the windmill has of late years been greatly improved and brought extensively into use. It is estimated there are over half a million windmills now running, and the annual increase in sales is estimated to be upward of 50,000. They are mainly used for pumping the domestic water supply; in many of the Western States a farm is scarcely considered to be complete unless it can boast of its windmill pump.

In some cases the mills are put to such work as cutting feed for stock, grinding corn, and the various lighter mechanical work of a farm. The success of the improved windmill in America has encouraged the manufacturers to push the trade in European countries and there is to-day a growing demand in the old world for these very useful and economical machines.

The chief drawback to the use of wind-driven motors is that the power is intermittent and uncertain. It has often been proposed to store up this power, so that the supply can be drawn upon in calm weather. This can undoubtedly be done; but whether such storage can be accomplished with economical results is open to question.

Water might be raised a certain height and stored in tanks prepared for the purpose. But on the basis that one horse power would require the lifting of 33,000 pounds one foot in one minute, it is evident that it would require large storage tanks and much time to lift enough water to provide a supply of any practical value. To this must be added the cost and care of a water motor to utilize this stored-up energy. A simple calculation shows that to furnish a constant supply of one horse power for a day of ten hours would require the daily storage of 47,000 gallons of water at a height of 50 feet. To accommodate this would require a tank 20 feet square and 16 feet high. To the expense of such a tank must be added the cost of the strong tower which would have to be built to carry at such a height this load of nearly 200 tons. The cost of receivers and motors for the utilization and storage of compressed air would in like manner largely neutralize any apparent utility of such device.

To store up sufficient electrical energy to run a one horse power motor for a day of ten hours would require a set of cells whose weight would be from 1,600 to 1,700 pounds. They would occupy some 20 cubic feet of space; and with the motor, belting, shafting and general fittings complete, the plant would cost about $500.

There would be a certain amount of drawback to the use of this system in the fact that the handling of a battery necessitates some technical knowledge and skill; a consideration that must necessarily limit the range of its application. Of the three systems of storage, the last mentioned would seem to be the best; and with further improvements in the way of automatic devices for regulating the charging and discharge of the batteries, we may look for a more extended use of this system in the future.

THE CHICAGO TIMES-HERALD MOTOR RACE.

It was extremely unfortunate that the weather should have interfered so seriously with the Chicago Times-Herald motocycle contest, which came off at that city on Thanksgiving Day. The recent storm had left the roads heavy with snow and mud. We are told that "for miles on the west side the boulevards were unbroken fields of snowbanks and slush." Six machines lined up for the start: The Duryea, of Springfield, Mass.; the Morris & Salom electrobat, of Philadelphia; the H. Mueller motocycle, of Decatur, Ill.; the R. H. Macy, of New York; the De la Vergne, of New York; and the Sturges electric motocycle, of Chicago. The Roger motocycle, with a view to giving it a long distance test, was started from New York to Chicago by road on November 15; but it was stalled by snow when it reached Schenectady.

Two of the machines covered the distance fixed for the race; the first being the design of an American inventor, Charles E. Duryea, of Springfield, Mass. His vehicle, a gasoline motocycle, covered the fifty-four miles in 10 hours and 23 minutes; a really creditable feat, when we consider the wretched state of the roads. The H. Mueller, also an American machine, was second, making the journey in 1 hour 35 minutes longer time. The De la Vergne, the Morris & Salom, and the Sturges electrical machine made no effort to cover any great part of the course.

The R. H. Macy had to retire after covering half the distance on account of broken running gear.

Although it is to be regretted that the recent storm should have spoiled this most interesting contest as regards the number of contestants and the rapidity with which the course was covered, we must bear in mind that the great severity of the test speaks all the more favorably for the excellence of the vehicles which completed the journey.

The storm of a day or two previous had completely paralyzed vehicular transportation in the very district where the Duryea motocycle completed a fifty-four mile journey at a five mile gait, and came in to the winning post none the worse for the trying ordeal. No better proof could be given of the all-round excellence of this vehicle. The greatest care must have been exercised in the proportioning of parts, and the general setting up, both of the motor and carriage, to enable it to battle for ten hours against the combined obstacles of mud and snow.

It is, moreover, greatly to the credit of the manufacturers that all this strength should have been obtained without the sacrifice of general appearance. As shown in the illustration, the Duryea motocycle is certainly an elegant "turnout," and for looks it could hold its own with the average horse carriage of to-day.

Undoubtedly the motocycle has come to stay. For private use, as compared with the horse carriage, it has many points in its favor. The space required for stabling would be merely that occupied by its own bulk; and its running expenses would be limited to the fuel consumed and such repairs as might occasionally be required.

We think that this new means of transportation is destined to play an important part in the question of city traffic. In the main thoroughfares of the larger cities traffic is badly congested. The adoption of the motocycle will largely relieve this, for the reason that it occupies only about one-half the space of the horse carriage; moreover, it turns in a much smaller circle, and is in every way more flexible in a crowded thoroughfare.

The metaphorical allusion to a flow of water in speaking of city traffic is well chosen. The "stream of traffic" is subject to the same laws as any fluid moving in a fixed channel. The more easily the particles adjust themselves to each other, the more rapid will be the flow, other things being equal. Nothing hinders the flow of traffic so much as a line of vehicles moving on a fixed track and having the right of way over other traffic. If such a thoroughfare as Broadway, in New York City, were asphalted from end to end, and its vehicular traffic carried on by various forms of the motocycle, its capacity would be largely increased.

The force of this statement will be realized by any one who has watched the ease with which the bicycle can thread its way through a crowded thoroughfare. Making allowance for its larger bulk, the motocycle shows an equal facility of control.

The general adoption of this vehicle, and the consequent removal of many thousands of horses from the streets of our cities, would result in greatly improved sanitary conditions. The introduction of the trolley and the cable car removed the nuisance in part, it is true, but it still exists. A gusty wind will raise at any time in dry weather a cloud of dust, which is composed more than anything else of pulverized manure. The gravity of this nuisance, viewed from a sanitary standpoint, is not generally appreciated. The adoption of any device, such as the motocycle, which will abolish the horse from a city's streets, would be welcomed by its sanitary officers as largely conducive to public health.

Wire Flywheel.

Among the most recent and novel applications of wire, attention is drawn in Hardware to the wire flywheel lately erected at the Mannesmann Tube Company's works, Germany, and especially notable, in view of the well known fact that heavy flywheels, driven at high velocities, present such dangers of breaking asunder from the great centrifugal force developed. The wheel at the factory mentioned is described as a cast iron hub or boss, to which are attached two steel plate disks or cheeks, about 20 feet in diameter. The peripheral space between the disks is filled in with some seventy tons of No. 5 steel wire, completely wound around the hub, the tensile resistance thus obtained being found to be far superior to that of any casting.

This huge flywheel is driven at a speed of about 240 revolutions per minute, or a peripheral velocity of 2·8 miles per minute, or approximately 250 feet per second, which is said to be nearly three times the average speed of any express train in the world. For such a constructed flywheel the length of wire is estimated at about 250 miles. The use of paper is also regarded with favor for large flywheels, the tensile strength of paper being enormous, and it is quite possible that some of the new big wheels will be built up with a paper rim.

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Wonders of the Mississippi.

A writer in Longman's Magazine says: The Mississippi has in the course of ages transported from the mountains and high land within its drainage area sufficient material to make 400,000 square miles of new land by filling up an estuary which extended from its original outfall to the Gulf of Mexico for a length of 500 miles and in width from 30 to 40 miles. This river is still pouring solid matter into the Gulf, where it is spread out in a fan-like shape over an extended coast line, depositing 362,000,000 tons a year, or six times as much soil as was removed in the construction of the Manchester ship canal, and sufficient to make a square mile of new land, allowing for its having to fill up the Gulf to a depth of eighty yards. Some idea of the vastness of this operation may be conceived when the fact is considered that some of this soil has to be transported more than 3,000 miles; and that if the whole of it had to be carried in boats at the lowest rate at which heavy material is carried on the inland waters of America, or say for one-tenth of a penny per ton per mile over an average of half the total distance, the cost would be no less a sum than $1,190,000,000 a year. Through the vast delta thus formed the river winds its way, twisting and turning by innumerable bends until it extends its length to nearly 1,200 miles, or more than double the point to point length of the delta, continually eroding the banks in one place and building up in another.

Paper Pulp Shoe Heels.

One of the latest features of wood pulp industry is the manufacture in Haverhill, Mass., of shoe heels from that material, white pine and other kinds being used for the purpose. In carrying out this art the plan as described consists in reducing the wood in the usual way in digesters, after which the pulp is put into a tank and mixed with the substances necessary for imparting to heel stock the necessary requirements such as alcohol, litharge, tar, degras and fish glue, a thorough mixing of these with the pulp being followed by soaking the same a day or two, so that the fiber may be penetrated, when another application of materials occurs. The object at this stage is to harden the pulp somewhat, so that it can be rolled into thick sheets and handled, shellac and borax accomplishing this, the pulp thus having the consistency of cement. At this point slakened lime is put in, and as this hardens when dry, the pulp must be rolled into sheets and cut into heels before the hardening takes place. With needed rapidity the pulp is now drawn from the tank in sheets, it being just thick enough, and there being specially arranged rollers and adjustments at the bottom of the tank for effecting this. A series of pressures through press rollers reduces the sheet to the right thickness, and the sheet is next placed quickly upon the bed of a cutter; the wheels are now started, and in a moment the platen falls, forcing a hundred or more cutters upon the sheet, shaping out a heel each.—N. E. Lumberman.

Artificial Fuel.

Anthracite briquettes have heretofore failed as fuel because the material has never been used in a sufficiently finely divided state. According to this invention, anthracite small coal ("duff") is passed through a disintegrator which will deliver it in such a condition that it will all pass through a sieve of at least twenty wires per linear inch, a finer condition being preferable. It is then mixed with (say) 6 per cent of equally finely powdered pitch, and the mixture is passed on to a pug-mill, wherein (say) 6 per cent of coal tar or other liquid hydrocarbon is incorporated with the mass. The mixture prepared in this way is heated by superheated steam and compressed into briquette moulds at a pressure of abou ttwo tons per square inch. If it be desired to render the briquettes smokeless, they may be gradually heated to about 800° or 900° C. It is claimed for these briquettes that each cakes separately in the furnace, that they are not deteriorated by rain, and that they are hard enough to bear tipping from a wagon or from sacks.—W. H. Biggs and R. R. Greenhow, Glamorgan.

Diastasic Ferments.

A mixture is made of sand (90 pounds), starch (10 pounds), and water (10 pounds), and the whole heated by steam until the starch is gelatinized. Wheat or maize flour is a convenient form of starch to employ. The steamed mass is cooled to 100° F., and then mixed with a small quantity of the spores of maize smut (Ustilago maydis). This is spread on trays and placed in a room kept at 80° F., the air of which is kept humid. The mould spores grow rapidly and in about thirty six hours the moisture is shut off, when the product quickly dries. If the growth be allowed to continue longer, spores are formed which are useful for subsequent operations.

The finished product, either before or after drying, is extracted with water; when it yields a solution rich in diastase, and which can be employed as a substitute for malt.—C. L. Hart, Chicago, U. S. A.

Cycle Notes.

The toll for wheelmen on the Brooklyn Bridge has been reduced from three cents to one cent, and legislation is now expected which will make the bridge free to all riders. The system of stopping to buy a ticket, which was collected a quarter of a mile further on, has also been abandoned, and the rider now drops a cent in a box at the end of a stick as he rides past the ticket seller's booth.

The question is often asked, "How long will a machine or the tires thereon last?" Everything depends in answering this upon the machine's weight, its quality, the weight of the rider, the character of the roads ridden and the care taken of the machine. But taking average conditions, a wheel should be ridable for four to six seasons, or at least 10,000 miles. With proper care, a well made pair of road tires should last the same length of time as the above estimate of a wheel's life, a pair having been known in England to have traveled 25,000 miles and still be serviceable.—The Wheel.

Cementing a tire to the rim is a task generally left to the repair man, as the thoughts of the trouble attached to heating the cement and preparing it for use are enough to make the average person forego any desire to try the job himself. A way to cement a tire to any kind of a rim without heating the cement is by taking hard red cement, grind as finely as possible and let it stand for several hours in a large mouthed bottle, first having covered with benzine. An occasional shaking should be given it, until the cement is thoroughly dissolved, when it is ready for use. The rim should be cleaned with a cloth saturated with benzine, and a heavy coat of the cement applied to the rim with a brush. Then apply benzine to the part of the tire that sets in the rim, put on the tire and inflate hard. A tire cemented on the rim in this manner will never work loose. In order to remove it, benzine should be forced under the tire to soften the cement. The application of cement will suffice for any number of tires, as once on the rim it always remains. To keep this cement ready for use, it should always be corked.—N. Y. Recorder.

[And to prevent explosion, see that there is no fire or flame within a mile of the benzine.]

In Vienna, Austria, all bicycle riders before obtaining permission to ride on the public streets are required to pass an examination. They are required to ride between boards laid on the floor without touching the sides or edges of them. At the word of command they must be able to dismount either right, left or backward; until the rider passes this examination satisfactorily, a license to ride on the public highway is refused him.

An American tourist is said to have recently sent his bicycle from London to Paris by mail at a cost of a few pence, and received it in perfect order. The English parcels post now carries mail packages not over twenty pounds in weight, and not of a higher value than $100, from any point in England to any place in France at what appears to be a ridiculously low tariff. The bicycle weighed just twenty pounds. The wheels and handle bars were removed from the frame and carefully wrapped in heavy paper, so as to make a compact bundle, before the postage was paid, and when the wrappings were removed at the tourist's hotel in Paris, the machine was in perfect condition.

In East Orange, N. J., the Board of Education has just erected a special building for storing the bicycles ridden by pupils. It is 60 feet long and 16 feet wide, with racks on both sides and a passageway between for the wheels. The wheels are stored here during school hours, the building being locked up by the janitor, and opened at noontime and at the close of school. This is probably the first building that has ever been erected as an annex to a school for the purpose of storing the bicycles of the pupils.

When the bicycle is put away for the winter, it should be thoroughly cleaned and vaseline or gun grease rubbed over all the bright parts, and the bearings should be flushed with oil. The tires should also be thoroughly cleaned, and the machine inverted so as to rest on the handle bar and saddle, so that the weight will not rest on the tire. A bicycle stand is still better, or the wheel may be suspended from the ceiling. The tires should be kept fairly hard during the winter.

A new horse and bicycle riding academy, of large dimensions, is now being erected in New York City, at Sixty-sixth Street and Central Park, west. A novel feature will be the bicycle ring upon the roof. 300 × 90 feet; there will also be a riding ring, 200 × 90 feet, and an inclosed bicycle ring, 234 × 90 feet.

The latest invention of the French is a bicycle for use on land and water. It is described in Hardware as follows: "The wheels are preferably of copper, their side plates inclosing a large central air space. The rear wheel, forming the drive wheel, has on its sides lateral blades to engage the water when the bicycle is so used, and its felly is toothed to enable it to take hold of ice when the rubber tire, which is only designed for land use, is removed. To hold the bicycle upright when used in the water, side weights are connected by suitable bails to the wheel axles, but when the machine is used on land, these weights are raised by chains which pass through a tube depending from the frame bars, links of the chain engaging a stop or pin to hold the weights raised. The saddle of the machine is of a form designed to prevent the water from splashing up against the rider, and has at its rear end a lateral mud and water guard."

Demand for Five Weeks Old Chickens.

At a large stock farm in Maryland, where a specialty is made of poultry, it is stated that 20,000 young chickens have been marketed in the year past, and that a single hotel in New York City would be glad to make a contract for the entire production. A "baby white" Plymouth Rock "broiler" is said to be the especial favorite, and one explanation of the manner in which they have come to be so popular is thus given by the Rural New Yorker: "A few years ago the family of one of our American millionaires went to Paris and ate a dinner at which little birds were served—one for each guest. They were smaller than ordinary broilers, one whole one providing about meat enough for each person. This seemed like an agreeable fad, and when they returned to America this family demanded these little birds in place of broilers. This fashion has spread among the rich until a plump chicken five weeks old will often sell for as much as a large broiler. Of course this means a gain to the feeder of at least a month's feeding. It just illustrates how changes in fashion strike below the surface into the production of articles of food. The rich and fastidious demand delicacies—fruits, vegetables and meats out of their natural season. This demand stimulates inventive genius, and men are found who invent the appliances needed to produce the artificial conditions required to grow plants and animals out of their seasons. These appliances are improved and extended until what was once a luxury becomes cheapened to a necessity, and rich and poor alike enjoy it. That is the history of forced fruits and vegetables, broilers, hothouse lambs, etc."

The Cost of Bad Roads.

The office of road inquiry of the Department of Agriculture has completed an interesting investigation relating to the use of the common roads of the United States. Returns have been received from about 1,200 counties, showing the average length of haul from farms to markets or shipping points to be 12 miles; the average weight of load for two horses, 2,002 pounds; and the average cost per ton per mile, 25 cents, or $2 for the entire haul. Estimating the farm products at 219,824,227 tons in weight, and making estimates on other articles carried over the public roads, it is calculated that the aggregate expense of this transportation in the United States is $946,414,665 per annum. Reports have been asked from the United States consuls abroad of the expense of hauling where the roads are good, so as to render possible a calculation which will show how much of this large outlay is due to bad roads. The estimate is ventured, however, upon information in the office of road inquiry, counting the loss of time in reaching markets, the enforced idleness and the wear and tear to live stock and hauling machinery caused by poor roads, that two-thirds of the cost might be saved by an improvement of the roads.

The British Cruiser Blake.

H.M.S. Blake recently had an eight hours' natural draught trial and a four hours' forced draught trial of her propelling machinery, subsequent to having her boilers retubed and fitted with Admiralty pattern ferrules in Chatham yard. Both trials were satisfactory, the original specified indicated horse power of 20,000 having been easily maintained. The Blake, it will be remembered, has two sets of triple expansion engines for each screw, and the designed piston speed was 840 feet. There are six double-ended boilers, each with eight furnaces, and an additional single-ended boiler for auxiliary machinery. The detailed results are as follows:

Date of trial	November 6, 1895.			
Nature of trial	Four hours full power, forced draught.			
Draught of water	Forward, 24 ft. 10 in.			
" " "	Aft, 27 ft.			
Speed of ship, knots	20 by log.			
Steam pressure in boilers	147 lb.			
Air pressure in stokeholds	2·3 in. of water.			
Revolutions per minute	Starboard, 96·5. Port, 99·1			
	Forw.	Aft	Forw.	Aft
Vacuum in condensers	26·8	26·3	26·9	26·5
Mean pressure in cylinders:				
High	54·7	50·8	55·8	52·5
Intermediate	39·0	40·2	37·2	35·9
Low	14·4	13·2	14·5	14·5
Indicated horse power, mean for each s.t	4,938	4,773	5,008	4,860
Total (starboard and port)	9,711		9,868	
Grand total	19,579.			

On preliminary trial the ship made 21·5 knots, and the indicated horse power was 20,132.

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THE CHAIN SAW MORTISER.

(Continued from first page.)

simple depression of the foot throws the belts and the table moves upward, pressing or rather feeding the work against the rotating chain. As fast as the table lifts the work the chain cuts into the wood until the limit of the depth is reached and the feed automatically ceases, the table is dropped and the work can be moved or shifted, the mortise being made absolutely complete by this operation.

It will be seen that a constant rush of chips must ensue upon the operation of the rapidly moving chain. These are thrown almost vertically upward to be caught by a hood bent over the upper sprocket wheel, from which hood opens the suction aperture of a small fan. The chips are drawn into the fan, which expels them by a pipe. For different mortises, chains and feeder bars of different widths are provided. In hard service a chain runs two weeks or more without sharpening. The sharpening is executed by an emery (or carborundum) grinder, the curve of the face of which is so regulated as to cause a slight protrusion of the outer corners of the teeth, in order to give the chain the proper bite. It is computed by absolutely disinterested parties that one chain saw mortiser will replace and do the work of three to five ordinary machines.

Every conceivable contingency is provided for in the machine The action is so purely a cutting one that it never splits the wood and can work in the most resinous kind of Georgia pine, in hardest hickory and elm or in smooth white pine with equal facility. For hard wood it is computed that it will sink a mortise with five or six times the rapidity of the ordinary machine. It never splits the wood and a mortise can be made so as to leave hardly the thickness of a piece of paper between the aperture and the side of the wood without splitting.

The machine is manufactured in a large and well equipped plant at New Britain, Conn., and the general agent is Mr. Sidney B. Whiteside, No. 139 Liberty Street, New York City. The machine can be seen in operation in numerous representative woodworking factories, among them the works of the Bradley & Currier Company of this city.

Improved Arms for the National Guard, New York State.

The New York State Board of Examiners, consisting of Albert D. Shaw, Eliphalet W. Bliss and Robert H. Thurston, appointed to select an improved magazine breech-loading rifle for the National Guard of the State of New York, in accordance with the terms of chapter 600 of the laws of 1895, gives notice that it will, on or before Tuesday, December 17, 1895, accept for examination and test, in compliance with the terms of said act, any magazine breech-loading rifle of American invention and manufacture, subject to such rules as may be prescribed in conformity with said act, due notice of which hereafter to be given. Said rifle may be delivered to the board or its representative at the office of the board, No. 17 Adams Street, in the city of Brooklyn, N. Y., on or before the 17th of December next. Notice of the time of examination and test and the methods to be adopted will be made later. Guns offered for test must be shipped at owner's risk and expense, each in a wooden case with hinged lid fastened with two suitable padlocks of different combination, each lock to have two keys, the keys of one to be retained by the owner, the others to be delivered to the secretary of the board when the case is received by him; all cases containing guns to remain in the custody of the board of examiners and at its disposal until the examination and test shall have been completed. No gun will be received without satisfactory proof that it is of American invention and manufacture; and every applicant will be required to furnish reasonable guarantee of compliance with the conditions contemplated by the law and the regulations made in pursuance thereof.

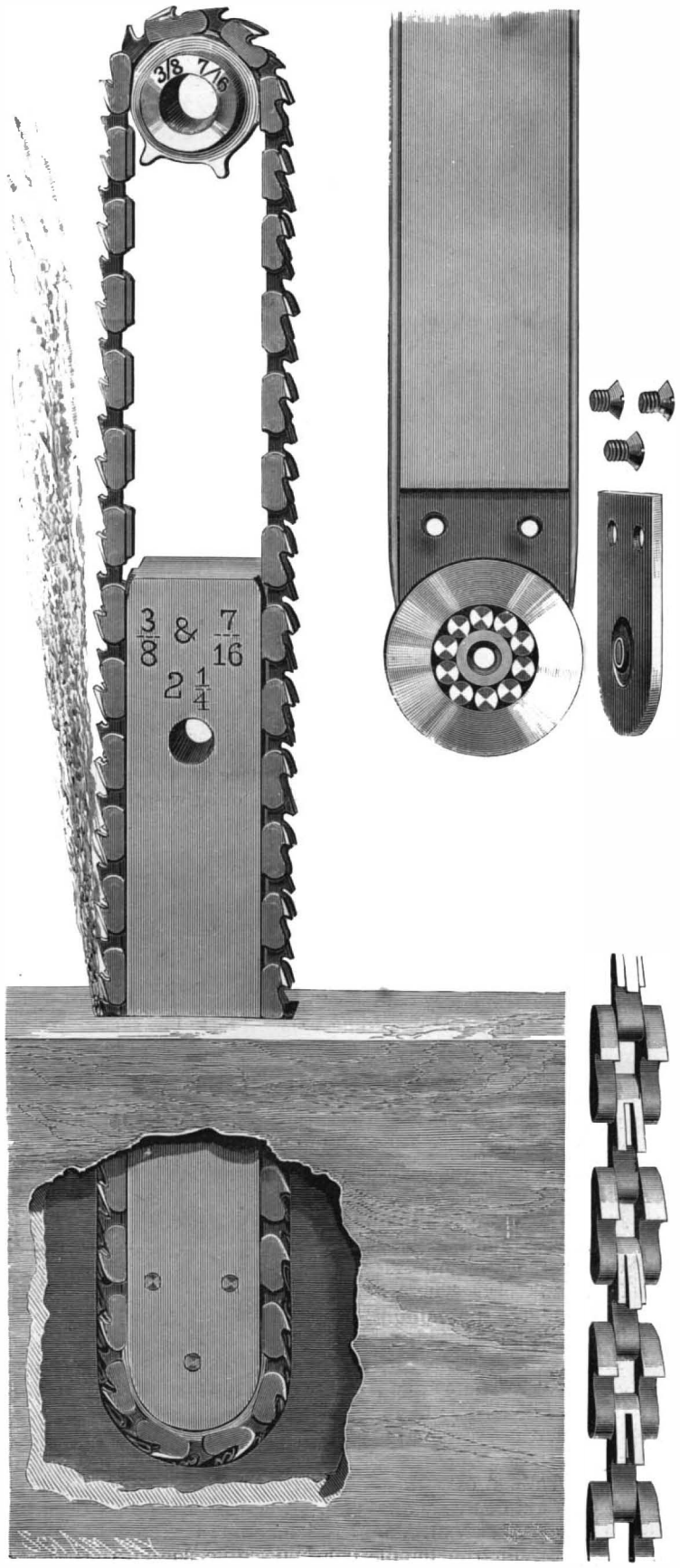
Printing in Several Colors.

According to F. Barnwell, Manchester, England, ordinary printing inks are treated with three mixtures successively. The first contains castor oil, turpentine, glycerine, oil of tar, and copaiba balsam; the second consists of sulphuric ether and chloroform; the third of liquid ammonia, spirits of ammonia (arom.), and ipecacuanha. After pouring off any liquid, the ink is ready for use. Inks of various colors so prepared may be used side by side on the same inking roller without in the least flowing sideways and mixing with one another, and thus several colors may be printed in one impression.

Photographic Mordants.

BY JEAN HELOUIS AND CHARLES DE SAINT-PERE.

This process allows to fix upon tissues, by the aid of the light, mordant dyeing dyestuffs, so as to produce designs or photographs upon the tissues by simple dyeing. After carefully cleaning the material by the usual processes, it is dipped into the solution of a substance which is sensitive to the action of light and susceptible of leaving a basic metallic oxide upon the fiber such as: the alkaline chromates and bichromates which leave a brown chromium oxide (ammoniacal sodium chromate, ammoniacal potassium chromate, bichromate of potash, of soda and of ammonia); the highest degrees of iron salts (perchlorids, oxalates, citrates, tartrates, bioxalates, bicitrates and bitartrates of iron); the uranium salts, especially nitrate of uranium; and the salts of copper, especially perchlorid.



DETAILS OF CHAIN AND FEEDER BAR.

The salts of gold, silver and platinum, although sensitive to the rays of light, are not available, because the finely divided metal which they leave upon the fiber has no affinity for dyestuffs. The material is in the dark impregnated with one of the above named salts, or a mixture of them, is dried likewise in the dark, and then under a photographic negative for a suitable time exposed to the light, when an image is formed, whose color and intensity vary according to the nature of the salt used. The tissue is then washed, in ordinary water acidulated with hydrochloric or sulphurous acid, for the alkaline chromates and bichromates, when the brown oxide, which has little affinity to dyestuffs, is transformed into a green oxide, which is a powerful mordant; or in ordinary water for the salts of uranium, iron, copper, etc. The materials can thus be dyed at once, or may be dried and put away until wanted to be dyed, either with natural or artificial mordant dyeing dyestuffs, as usual.—Mon. d. l. Teint.; Textile Colorist.

Melting Points of Metals.

M. Pictet remarks that pure metals with high melting points, such as platinum, iron, copper, and gold, are all comparatively strong, and that, conversely, metals having low melting points—zinc, lead, bismuth, and tin—are relatively weak; that metals with high melting points must necessarily be coherent and tenacious, because much heat is required to drive their molecules apart in reducing them to the liquid mobile state in which the molecules have very small coherence, and therefore at ordinary temperatures much force must be applied to overcome the cohesion of the molecules and break the mass. On the other hand, in metals with low melting points a slight elevation of temperature will overcome the molecular cohesion and render them liquid, that is, will melt them. Such metals will be weak, because if little heat is required to melt the metal, less force will be needed to tear it apart; hence melting point and tenacity are clearly connected. It is also shown that the tenacity of pure metals and alloys is greatly increased by extreme cold, that is, by the closer approximation of their molecules, proving that metals become stronger at temperatures furthest removed from their melting point.

Do Birds Reason?

In the spring of 1894 I put up two high poles in my yard; at the top of these I placed two boxes, each containing two compartments; one of these poles was intended for my old associates the purple martins (P. purpurea) who generally arrived between the middle and last week of April; to sojourn with us until the fall reminds them of their autumn migration southward.

The other pole was for the occupation of my little friends the wrens (T. aedon), who arrived a little earlier than their above neighbors.

The wrens (two pairs) duly arrived, and after closely inspecting every knot hole and crevice to be found, in or about the outhouses and barn, finally selected the box appointed for them; which, although a new one to them, occupied the place of an old one, which had been taken down the previous winter; and in which they had nested for some years. They rapidly commenced work, and soon numerous sticks adorned their respective compartments; when suddenly a pair of English sparrows (P. domesticus) put in an appearance, and driving away its occupants, took forcible possession of both compartments. The wrens retreated and disappeared, but in the short time of ten minutes returned with reinforcements, consisting of about seven or eight other wrens, who after a sharp conflict drove the intruders from the field.

The sparrows, in about fifteen minutes, also returned, they in their turn having picked up about ten recruits, and vigorously attacked and put to flight the whole army of wrens.

While attentively watching the battle, and considering it about time for my interference, I noticed a wren slip over my birdhouse, and enter one of the compartments of the martin box, which was upon a much higher pole, and distant about ten yards from their pole, upon whose box the victorious sparrows were chippering and showing every sign of victory.

The wren soon stole away and disappeared, and one of the female martins came out of its compartments, and was soon joined by the other female; in a few minutes the male martins arrived very closely together, and uttering a few notes all four charged the sparrows, and in a minute or two had completely routed the aggressors, who never returned; the martins returned to their box, and soon the four wrens came back, and settled down happily.

I thought this was a clear case of bird sense, and bird language on the wrens' part; for finding they could not hold their own, appealed to their neighboring wrens first, but where they found them so quickly I could not say, for I only knew of one nest, about two hundreds yards distant, also their shrewd policy, when the enemy was reinforced, in applying for help to their powerful neighbors.

The martins attacked the sparrows in a similar way that bee martins employ in fighting hawks or other birds who approach their nests.—E. Kroy, in the Museum.

An Immense Flywheel.

An immense flywheel, twenty-eight feet in diameter, having a face four feet broad, and weighing 180,000 pounds, is on its way from Philadelphia to Joliet, Ill. It is being transported in two sections, on two cars built for the purpose.

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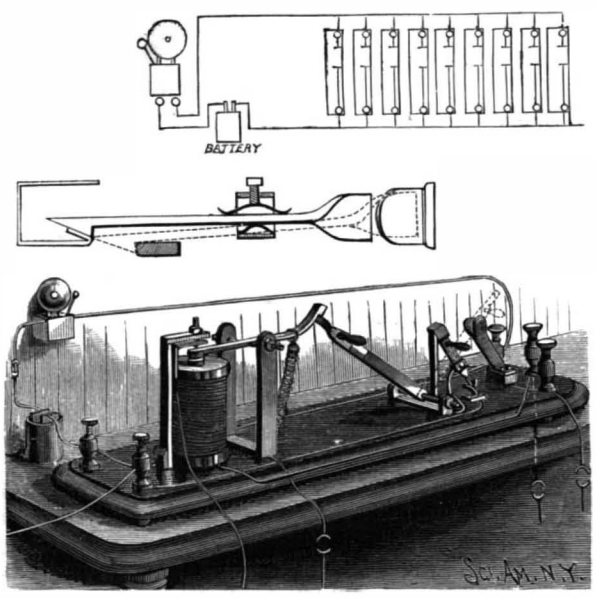
A LIGHTNING AND HEAVY CURRENT ARRESTER.

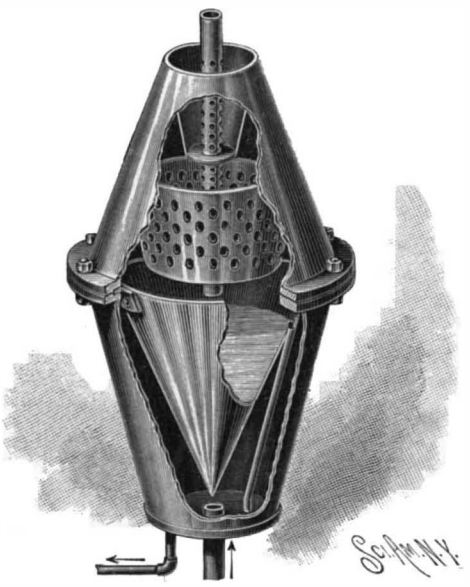
The illustration represents a current arrester, charge grounder, open-circuit alarm, and automatic live wire tester, patented by Miller R. Hutchison, of No. 18 North Commerce Street, Mobile, Ala. It is intended to protect telegraph, telephone, fire alarm, call bell, and all low-potential instruments that are liable to damage from lightning and live wires, giving notice by an alarm bell of the passage of a heavy current, and determining whether it is due to a stroke of lightning or a continuing and dangerous current from a live wire of high potential. The ordinary line current, entering the instrument at a binding post, passes by wire into jaws on the base of the instrument, thence through a bar constituting a drag switch and into a support, and through an upright and wire to the metal bearing in which is journaled a spring-actuated pivoted shunt bar, the limit of the motion of which is indicated by the dotted lines. From the shunt bar the current passes to a pivoted armature lever normally held out of contact with the magnet by a spiral spring, the bottom end of the magnet wire being also connected with the bearing in which the armature lever is journaled, and the magnet being connected with a ground wire. When a live wire or heavy charge of lightning strikes the line wire, the magnet attracts the armature lever to free the shunt bar from its catch at the other end of the lever, when the shunt bar springs over to the position shown by the dotted lines, and into contact with spring jaws forming a shunt bar support and holder, a grounding wire from which grounds the charge and entirely cuts out the magnet. At the same time the rising of the armature lever effects contact, through a standard, with the terminals of a bell circuit to sound an alarm, the alarm bell ringing continuously until the instrument is reset. This may be effected by grasping a rubber handle of the shunt bar and pulling it over until its end is caught by the catch of the armature lever but in case the alarm had been caused by a live wire, this would burn out the magnet before the armature lever could be again removed from contact, and as a precaution against this provision is made for opening the circuit automatically through the drag switch, the detail of which is shown in one of the small figures. With this switch in circuit there is no current on the shunt bar when reset by the operator, and not until the circuit is reformed by adjusting the drag switch, when, if the heavy current is still on, the shunt bar quickly and sensitively parts from the catch of the armature lever, and the magnet is not burned out. For switchboard use, or where more than one instrument is used, the instruments may be arranged on a table, as shown in one of the small figures, the connections being so made that the alarm will be rung from any one of the instruments.



HUTCHISON'S CURRENT ARRESTER.

AN IMPROVED STEAM CONDENSER.

The illustration represents a simple and inexpensive condenser designed to condense exhaust steam at a relatively high temperature, thus obviating excessive back pressure on the engine piston. The improvement has been patented by Michael and James V. Spelman and William H. Graves, of Shreveport, La. The shell of the condenser is formed of two parts, united by flanges and bolts, and within its lower part is an inverted cone receiving vessel having an overflow pipe delivering into the bottom of the shell. Above the receiver is an inverted cone perforated distributer, supported by the upper part of the shell immediately below a deflecting cone wherein slides a vertical perforated tube, to more or less fully close the outlet from the condenser. The exhaust pipe delivers into the condenser centrally at the bottom (the drain pipe leading from one side), and the entering steam is directed upward in divided currents until it strikes the deflecting cone at the top, when it is forced downward through the distributer, to be further divided and thrown evenly throughout the whole upper part of the shell, causing it to condense rapidly, and the water of condensation being caught by the receiver and flowing out through the drain pipe.



SPELMANS & GRAVES' STEAM CONDENSER.

THE CHICAGO MOTOCYCLE RACE.

In 1894 a great impetus was given to the automobile carriage by a competition organized in Paris by the Petit Journal. The course was from Paris to Rouen, 75 miles, and the prizes amounted to $2,000. Fifteen competitors started in the race, the best time being 5 hours and 40 minutes. On June 11, 1895, occurred another race in France, for prizes aggregating $8,000. The course measured 727 miles, and was from Paris to Bordeaux and return. Sixty-six vehicles competed, and the best time was made by a petroleum carriage, which made the entire journey in 2 days and 53 minutes, or at the rate of 14·9 miles an hour.

With a laudable intent to awaken widespread interest in the motocycle, two papers offered last July substantial prizes aggregating $10,000 to be competed for by horseless vehicles. The Chicago Times-Herald offered $5,000 in four prizes for the winners in the race of November 2, and the Engineer of London offered about $5,000 for a race to be held in England Under the existing law in England, which prohibits the use of steam carriages on the roads at a greater speed than four miles per hour, no adequate competitive trial could take place, but a repeal of the law is confidently expected, so that allowing time for necessary legislation the competition can scarcely take place at an earlier date than October, 1896. No vehicle must weigh over two tons, the limit being fixed by the Shaw-Lefevre bill, which was introduced during the last Parliament. When the Times-Herald first made its offer, it was feared that the time was too short for American inventors to construct motocycles which would stand a fair trial when compared with the skilled construction of the most experienced French and German makers. This prediction was fulfilled, for out of nearly one hundred machines entered, and after a postponement of over three weeks, only six contestants started on Thanksgiving day morning, November 28. It is probable the terrible storm just preceding the day fixed for the trial and the accumulation of snow and mud deterred many from appearing.

The route selected was as follows:

Midway Plaisance, Washington Park, Fifty-fifth Street Boulevard, Michigan Boulevard, Rush Street, Lake Shore Drive through Lincoln Park, the Sheridan Drive and Kenmore Avenue to Evanston; thence south on Clark Street and Ashland Avenue to Roscoe Street and Western Avenue, west on Belmont Avenue, southeast on Milwaukee Avenue to Humboldt Boulevard and through Humboldt, Garfield and Douglas Parks to Western Avenue Boulevard, east on Fifty-fifth Street boulevard and Washington Park to Jackson Park and the Midway.

Three days before the race, Chicago was visited with a veritable blizzard, which almost entirely cut off the city from telegraphic communication, crippled railroads, and brought the cable and trolley cars to a standstill. The streets were choked with snow, which was soon mixed with the accumulations of dirt, until they became well nigh impassable. The snow was 12 inches deep in places. It was in the midst of this city of snow and slush that six motocycles started for their race at 8:55 A. M. on Thanksgiving morning.

The vehicles competing were: The Duryea motor carriage, of Springfield, Mass.; the Morris & Salom electrobat, of Philadelphia, Pa.; the Benz-Mueller motocycle, entered by Mr. H. Mueller, of Decatur, Ill.; the Roger motocycle and the De la Vergne motocycle, of New York; and the Sturges electric motocycle, of Chicago.

The course was fifty-four miles long. The De la Vergne machine quit at Sixteenth Street; the Morris & Salom electrobat and the Sturges electric motocycle made short runs and then dropped out of the race. Both the electric vehicles returned in good condition and made a good showing under the circumstances. The Roger machine broke its running gear when half of the course was covered and lost the race.

The probable winner of the first prize was the Charles E. Duryea gasoline motocycle, which made the fifty-four mile run in ten hours and twenty-three minutes.

The Benz-Mueller motocycle came in second, covering the course in eleven hours and fifty-eight minutes. Considering the condition of the roads, this showing was very satisfactory. An engraving of this machine will be found in our paper of November 16, 1895. The prizes offered were as follows:

First prize—$2,000 and a gold medal, the same being open to competition to the world.

Second prize—$1,500, with a stipulation that in the event the first prize is awarded to a vehicle of foreign

THE DURYEA FIRST PRIZE MOTOR WAGON.

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invention or manufacture, this prize shall go to the most successful American competitor.

Third prize—$1,000.

Fourth prize—$500.

The third and fourth prizes are open to all competitors, foreign and American.

We present an illustration of the first prize winner. The Duryea carriage is made by the Duryea Motor Wagon Company, of Springfield, Mass. The Duryea wagon weighs about 700 pounds and is built for either two or four persons. The one shown in the engraving is arranged for two people. It is driven by two three-horse power motors, which use ordinary stove gasoline, so that the expense of running is less than one-half cent a mile.

The wagons have a carrying capacity of eight gallons, so that they will run from 100 to 200 miles. The wagon needs recharging with water each day, and both the gasoline and water can be supplied to the wagon in five minutes. The object of the tank of water is, of course, to prevent the motor from overheating. Its runs backward or forward with equal facility, and has four speeds forward and one speed backward. It can be geared to different speeds to suit the roads of any locality, and may be run at any speed desired below its limit over roads over which ordinary traffic travels. The wheels of the carriage are 34 and 38 inches in diameter and are equipped with 2½ inch pneumatic tires, and it is easily governed, being steered and speeded by the same lever, being steered by a sidewise motion of the lever and speeded by a vertical motion. It is provided with a powerful brake, and as its motors are wholly independent, one will propel the carriage even if accident affects the other. As an electric spark explodes the charge, the danger of explosion is reduced to a minimum.

A Drop of Water.

The water which is now in the ocean and in the river has been many times in the sky. The history of a single drop taken out of a glass of water is really a romantic one. No traveler has ever accomplished such distances in his life. That particle may have reflected the palm trees of coral islands, and has caught the sun ray in the arch that spans a cloud clearing away from the valleys of Cumberland or California. It may have been carried by the Gulf Stream from the shores of Florida and Cuba, to be turned into a crystal of ice beside the precipices of Spitzbergen. It may have hovered over the streets of London, and have formed a part of murky fog, and have glistened on the young grass blade of April in Irish fields. It has been lifted up to heaven and sailed in great wool-pack clouds across the sky, forming part of a cloud mountain echoing with thunder. It has hung in a fleecy veil many miles above the earth at the close of long seasons of still weather. It has descended many times over in showers to refresh the earth, and has sparkled and bubbled in mossy fountains in every country in Europe. And it has returned to its native skies, having accomplished its purpose, to be stored once again with electricity to give it new life-producing qualities and equip it as heaven's messenger to earth once more. —Chas. S. Whiting, in the Museum.

Calcium Carbide.

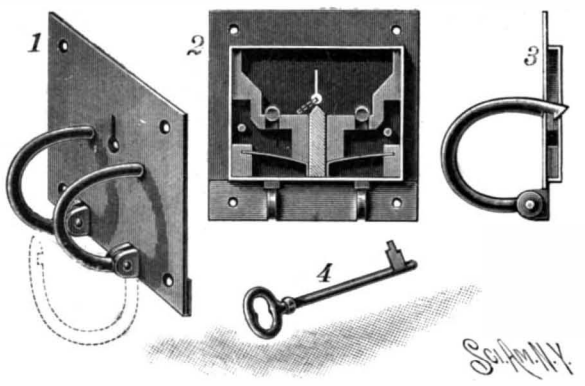
At the annual meeting of the German Electro-Chemical Society, Dr. Borchers exhibited an apparatus by which he not only succeeded, nearly ten years ago, in preparing calcium carbide, but also showed that all the oxides which were regarded as irreducible could easily be reduced by the action of carbon. It consists of a small chamber or furnace of fire brick, through the walls of which pass thick carbon rods 40 mm. in diameter. Inside the chamber these are connected by a thinner carbon rod, 4 mm. in diameter and 40 mm. long. The furnace is fed with a mixture of lime and carbon. The action is not electrolytic; the effect of the current being simply to heat the lime to a temperature at which it is reduced by the carbon. An E.M.F. of 12 volts and a current of 90 amperes is used. The current may be either direct or alternating; and by diminishing the length of the thinner rod calcium carbide can be produced with an E.M.F. of only 1 volt, so that electrolysis is out of the question. The reactions which take place are: (1) $CaO+C=Ca+CO$; (2) $Ca+C_2=CaC_2$.

The above reactions are supposed to have been discovered by Moissan and Wilson, but the author refers to publications by Wöhler (1862) and himself (1891).—Zeits. f. Elektrotechnik. u. Elektrochem.; Jour. Soc. Chem. Ind.

POTASSIUMORTHODINITROCRESOLATE is the name of a new antiseptic discovered in Germany, but as it is intended to be used generally, it is also called antinounin. One part of the substance in from 1,500 to 2,000 parts of soapsuds is destructive to all the common parasites injurious to plants. Yeast used in brewing remains fresh for a long time when treated with it; it destroys all bacteria, and yeast can endure a solution as strong as five per cent of the substance. It is odorless and very cheap.

A KEY RETAINING DEVICE.

For holding and securing keys in asylums, prisons, hotels and other places where many keys are required to be kept for the usual service, holding them in such way that they can only be removed by one having the proper release key, the improvement shown in the accompanying illustration has been patented by Richard Hensley, of Salem, Oregon. Fig. 1 is a face view of the device, which is represented in section in Figs. 2 and 3, Fig. 4 showing the key. The key-holding hook is pivoted to swing down, as shown in dotted lines, and at its upper end is a bevel and notch adapted to engage a bolt of the lock on the rear of the face plate, as



HENSLEY'S LOCKING BOARD FOR KEYS.

shown in Figs. 2 and 3, the bolt being spring-pressed and being disengaged from the hook by the release key.

THE LEBER PATENT PORTABLE FIRE ESCAPE.

A simple and inexpensive portable fire escape, which may be packed in small compass to take but little room in a traveler's trunk or bag, is shown in the accompanying illustration. It has been patented by Victor Leber, and is manufactured by the Turner Machine Company, of Danbury, Conn. It consists of a clamp adapted to slide upon a rope, as shown in the small figure, the clamping or frictional pressure upon the rope being readily controlled by the person using the device. The two hinged parts of the clamp are provided with registering half grooves adapted for convenient use on different sizes of rope, and the clamp is held in gripping position upon the rope by a threaded locking lever on the outer end of which is a finger wheel. At the top and bottom of the clamp are rings through which the rope passes, affording a slight frictional brake, and at the bottom is also a double hook to which may be attached body and shoulder straps to support one

THE LEBER PATENT PORTABLE FIRE ESCAPE.

making use of the device in escaping from a building. When the escape is permanently fixed in houses or factories, the rope is preferably attached to a hinged arm secured at the inside of the window casing. The device may also be secured to the window casing. When several persons are in one room, the frictional pressure of the clamp may be controlled by one standing in the room to let down different individuals in turn, the looped end of the rope being then secured to the straps by which the person is suspended, and the rope sliding through the clamp. As one person reaches the ground, it is ready for another to descend. Each apparatus is tested to 1,000 pounds before leaving the factory of the manufacturers, and the whole device is designed to be so simple and safe in its mode of operation that there shall be no reasonable possibility of a person failing to make it work properly in an emergency. This apparatus may also be conveniently employed by painters, builders and electricians, and by all engaged in work necessitating their being suspended outside buildings.

Remedial Foods.

This list of food remedies compiled by the Housekeeper is well worth preservation for reference:

Celery is invaluable as a food for those suffering from any form of rheumatism; for diseases of the nerves and nervous dyspepsia.

Lettuce is useful for those suffering from insomnia.

Water cress is a remedy for scurvy.

Peanuts for indigestion; they are especially recommended for corpulent diabetes. Peanuts are made into a wholesome and nutritious soup, are browned and used as coffee, are eaten as a relish, simply baked, or are prepared and served as salted almonds.

Salt to check bleeding of the lungs, and as a nervine and tonic for weak, thin-blooded invalids. Combined with hot water is useful for certain forms of dyspepsia, liver complaint, etc.

Onions are almost the best nervine known. No medicine is so useful in cases of nervous prostration, and there is nothing else that will so quickly relieve and tone up a worn-out system. Onions are useful in all cases of coughs, colds and influenza; in consumption, insomnia, hydrophobia, scurvy, gravel and kindred liver complaints. Eaten every other day, they soon have a clearing and whitening effect on the complexion.

Spinach is useful to those suffering with gravel.

Asparagus is used to induce perspiration.

Carrots for suffering from asthma.

Turnips for nervous disorders and for scurvy.

Raw beef proves of great benefit to persons suffering from consumption. It is chopped fine, seasoned with salt, and heated by placing it in a dish in hot water. It assimilates rapidly, and affords the best of nourishment.

Eggs contain a large amount of nutriment in a compact, quickly available form. Eggs, especially the yolks of eggs, are useful in jaundice. Beaten up raw with sugar are used to clear and strengthen the voice. With sugar and lemon juice, the beaten white of egg is used to relieve hoarseness.

Honey is wholesome, strengthening, cleansing, healing and nourishing.

Fresh ripe fruits are excellent for purifying the blood and toning up the system. As specific remedies, oranges are aperient. Sour oranges are highly recommended for rheumatism.

Watermelon for epilepsy and for yellow fever.

Cranberries for erysipelas are used externally as well as internally.

Lemons for feverish thirst in sickness, biliousness, low fevers, rheumatism, colds, coughs, liver complaint, etc.

Blackberries as a tonic. Useful in all forms of diarrhœa.

Tomatoes are a powerful aperient for the liver, a sovereign remedy for dyspepsia and for indigestion. Tomatoes are invaluable in all conditions of the system in which the use of calomel is indicated.

Figs are aperient and wholesome. They are said to be valuable as a food for those suffering from cancer. They are used externally as well as internally.

Bananas are useful as a food for those suffering from chronic diarrhœa.

Pieplant is wholesome and aperient; is excellent for rheumatic sufferers and useful for purifying the blood.

Alumina from Clay.

An important contribution appears in Comptes Rendus, by Heibling, indicating the production of alumina from clay, so as to be absolutely free from silica and readily convertible into sulphate, etc. To this end the clay is thoroughly incorporated with a mixture, in equal parts, of ammonia and potassium sulphates, in such proportion that three molecules of ammonium sulphate may be present to every molecule of alumina, and the mixture is made into hollow bricks, which are then heated in an oven at 270 deg. to 280 deg. C. At this temperature both gaseous ammonia and acid ammonium sulphate are given off, which immediately reacts with the potash salt present, acid potassium sulphate being formed—the latter, at the above temperature, combining with the alumina of the clay to form alum. The alum is finally extracted from the bricks by means of water and freed from iron by recrystallization, and the insoluble silica remaining behind may be employed in cements. Granular alumina is prepared by spreading out the powdered alum in a thin layer on shelves arranged in a vertical tower, which is traversed by the warm, moist, ammoniacal fumes derived from the brick oven. Thus the alum is transformed in situ into alumina, retaining the form of the original powder, and potassium and ammonium sulphates.

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Correspondence.

Discovery of Two New Comets.

A NEW COMET BROOKS.

To the Editor of the SCIENTIFIC AMERICAN:

I have the honor to announce to the readers of the SCIENTIFIC AMERICAN my discovery, at two o'clock this morning, of a new comet in the southeastern sky. It is situated on the border of the constellation Hydra, and its position at discovery was right ascension 9 hours 51 minutes 50 seconds; declination south 17° 40′, with a northerly motion. The comet is round, quite large, and moderately bright telescopic.

WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y.,
November 22, 1895.

A dispatch from Geneva dated November 28 states that Prof. Brooks secured another observation of his new comet on that date after six days of cloudy weather. Its position is 9 hours 29 minutes 30 seconds, and declination south 47 minutes. The comet is moving northward into the constellation of Leo.

A telegram received at Harvard College Observatory, November 17, announces the discovery of a bright comet by Prof. Perrine, of the Lick Observatory, at San José, Cal.

The position of the object is as follows: November 17, 0·06 Greenwich mean time, right ascension 13 hours 44 minutes; declination north 1° 40′.

The comet has a short tail and a stellar nucleus of about the seventh magnitude as seen in the morning twilight.

The Perrine comet was also observed on November 28 by Prof. Brooks; its position being 14 hours 14 minutes, declination south 5° 15′. It is moving southward and growing brighter.

Fireproof Buildings.

To the Editor of the SCIENTIFIC AMERICAN:

I was forcibly impressed with your article on the "Defects of Fireproof Buildings," published in the SCIENTIFIC AMERICAN under date of November 23, and especially was I interested in the details given in the construction of the Manhattan Savings Institution building, now in ruins.

This latest among the horrors (the work of man's best friend when controlled, but worst enemy when uncontrolled) is but another evidence of the short sight of our most progressive men. They rear their lofty fireproof (only in name) palaces regardless of expense and think every contingency against disaster is provided for, when lo! they wake to the realization that some vulnerable and exposed feature has been entirely overlooked after the fire has consumed their boasted fireproof structure. It does seem that some system ought to be found that would be a positive and never failing proof against an attack of fire from the outside, and such a scheme being effectual would prevent ninety per cent of the destruction by all conflagrations.

Now there is a simple, logical, and undeniable fact, which is no less than this: Water will not burn and it cannot be heated when exposed to the atmosphere to more than 212°. Suppose the windows on a brick building were covered with double galvanized iron shutters, open at the top, with outside sheet one-half inch shorter or lower than the inside, and suppose they were filled with water when danger threatened, and kept filled even during the fiercest fire that could be thrown against them. How could the fire get inside that building? You could put your hand on the inside of such a shutter at any time during a fire that consumed the next building. To get the water in such shutters and keep up the supply is an easy matter. A tank on the roof or a connection with any water main or steamer through a system of pipes laid in the walls and either over every shutter when shut or through properly constructed hinges, would meet the case. Where millions are spent in the erection of what are otherwise mainly fireproof buildings, it seems like folly to neglect such simple precaution as would be a positive barrier to fire entering by windows on the outside.

To illustrate the manner in which practical men view the ideas of other men, I relate this instance: Some twenty years or more ago the writer was impressed with the facts as above stated, and called upon the head of the house in your city which furnishes most of the ironwork for buildings and stated his plan for a positive fireproof shutter. The old gentleman listened with attention and turned to his desk again, dismissing the subject entirely with the remark, "It is no good, they would freeze up in the winter." He did not wait to hear me say that I did not propose to let water in them until there was danger of fire.

If I ever build a brick building in the city, it shall have such shutters on the windows.

D. H. WYCKOFF.

Asbury Park, N. J., November 25, 1895.

AMONG the deep coal mines in Europe is one at Lambert, Belgium. Depth, 3,490 feet.

A Warning to Fat People.

A Berlin professor has just discovered that for fat persons to employ any means whatever to reduce their flesh is likely to injure their health and shorten their lives. The Literary Digest quotes the abstract of the professor's article, with comments thereupon.

"Fat men, do not try to make yourselves thin. It is thus that Professor Eulenbourg, of Berlin, adjures you in one of the last numbers of the German Medical Weekly. It is not that he would advise you to persist in your obesity, but he has discovered that all the means that you may employ to be rid of it would have the effect of ruining your health, and even shortening your life. Against all these he would place you on guard. For example, he is indignant that permission should be given to German druggists to sell, without an order, to the first comer, tablets and potions which might perhaps cure obesity, but which injure the organism and produce grave troubles of the nerves and the blood, for all of them contain some poison, and it would be much better to be fat and healthy than a lean valetudinarian. Among other examples of the disastrous effects of the cures of obesity, Dr. Eulenbourg cites the case of a well known dramatic artist, who, not content with the opulence of form which Nature had given him, became so thin that he died in consequence. But it is not the treatment alone that is dangerous. Scarcely has the man the opportunity to enjoy his diminishing obesity, before disquieting symptoms begin their appearance, his humor alters, he becomes nervous, impressionable, and from day to day he has no more the feeling of being in his natural state. . . .

"It seems to be clearly proved that we cannot make ourselves thin with impunity. Nature creates the fat and the lean, and it is the part of wisdom for one and the other to resign themselves to their condition. But just here humanity seems to fail, and it is to be feared that the most serious discoveries, as well as the most dangerous advertisements, will fail to prevent people who are too fat from making themselves thin, no matter how. Why did not Professor Eulenbourg, instead of discovering the dangerous chemical properties of the remedies for obesity, try to discover that obesity was graceful, and more beautiful than the opposite state? Upon this condition alone would his advice be heeded, And after all, who can prove the æsthetic superiority of the thin over the fat? That's but a matter of fashion, the result of a new taste, that may change from one year to another. Is it not time to honor the ancient ideal of fat beauty? Would it not prevent the disastrous effects of all the remedies for obesity?"

Electric Railway Losses.

Professor Hermann S. Hering, of Johns Hopkins University, contributes to the Electrical World of November 9 a timely and valuable paper on the above subject.

The figures which he quotes are the results of an elaborate series of tests, which were carried out on a strictly scientific basis. They are certainly very startling; and those which deal with the question of losses resulting from the ignorance or carelessness of the motorman show once again how important a factor in the economics of transportation is the "human element."

The paper treats of four factors that determine the economical working of electric roads: The roadbed, the motorman, stopping and starting, and weight, or the ratio of dead to live load.

1. The Roadway. — As distinguished from steam roads, the electric road is too often surveyed and built by unskilled engineers, with the result that the best possible location that the topography of the route affords is seldom found. Railroad surveying is a special branch of civil engineering, and it takes years of experience to enable the locating engineer to acquire the faculty of producing the best possible line for operation upon a given route.

Grades should be as even as possible, not "choppy;" curves should be compound, or what is better known as "transition" curves, in which the track commences and ends in a curve of easy sweep, sharpening toward the center. Change of grade should always be marked by vertical curves.

The number of turnouts should be reduced as far as possible. After the revision of a piece of badly located line careful tests showed an increase of speed of 12½ per cent, and a decrease of the average current of 12 per cent on the up grade trip and 7 per cent on the round trip.

2. The Motorman.—"By far the largest part of the electrical energy used by the cars is expended in accelerating and lifting them;" that is to say, in starting and in hill climbing. If a car be driven to the top of a hill, it represents, by the time it reaches the summit, an amount of energy which an intelligent motorman will carefully husband on the down grade, using only as much current as will start it and utilizing the "drifting" capacity of the car when it reaches the level for as great a distance as possible.

"Motormen frequently use current on a down grade when it is totally unnecessary and then jam down their brakes when reaching the foot of the grade, which results in a total loss of this energy."

The tests show that 74 per cent of the total energy expended per car mile in city work is used up in lifting and accelerating, and only 26 per cent for horizontal traction!

It is obvious at a glance that, if only some means of storing this energy could be devised, a vast saving in cost of operation would be at once effected. Every time a stop is made on the down grade a portion of this energy is converted into useless heat at the brake shoes and so lost. If the brake effect could be secured by causing the car axle to charge suitable accumulators on the car, this energy could be thus transformed and used for propulsion on the level or up grade.

On a basis of cost of one cent per kilowatt hour, if only 50 per cent of this energy of starting and hill climbing could be stored, it would mean a yearly saving of $15,700 on a 100 car road, the cars making fifteen 10 mile trips per day. This sum, capitalized at 5 per cent, would amount to $314.000.

"The brakes should be used as little possible, and the cars allowed to drift as much as possible."

A test to ascertain what saving could be effected by intelligent handling of the controller was made by placing one of the electrician's assistants on a car that had just been brought in by a motorman, and letting him run it on the same schedule time, but with special attention to economy. The load and the stops made were similar in each case.

The special motorman showed an economy of 15 per cent on the up grade and of 26 per cent on the down grade, over the other. Taking one-half this difference, or 10 per cent, as a basis, it is seen that the total saving in one year of city work on a 10 mile, 15 trip, 100 car electric road would be no less than $7,000, representing a capitalization of $140,000. Evidently it would pay the electric railway companies to give their motormen some special training.

3. Stopping and Starting.—One hundred tests gave the energy used in starting a car as 85 watt hours. On this basis it is seen that one extra unnecessary stop per trip on a 100 car road, making 15 trips per day, is $467 per year. From this estimate it is evident that a great economy would be realized if regular stopping "stations" were arranged and the promiscuous stopping abolished.

4. Weight of Car.—It was found that a reduction in the weight of the car of 1,000 pounds means a saving of 10 watt hours per car mile. This on a 10 mile, 100 car road, as above, would amount to $584 per year. We are told that the paying load on city roads averages only "10 to 15 per cent for the day."

We would point out, in closing our notice of this valuable article, that the economy in operation above mentioned will, in every case but the last, conduce to the comfort of the traveling public. A well-located line, with "easement" or "transition" curves, will abolish the violent lateral lurching at street corners and elsewhere, and gradual acceleration in starting, with a minimum of braking, will relieve the passengers of most of the longitudinal or "fore and aft" jolting which characterizes the present methods of the motorman.

Solidified Milk—B. F. McIntyre's Process, East Orange, N. J.

The object of the process is to prepare condensed milk in a semi-solid or powdered form, employing a low temperature so as to avoid changing the albuminoids, and discoloration, and melting of the fat globules; also to sterilize and preserve the product in a non-oxidizing gas.

Large quantities of milk are first separated in a centrifugal separator, and the milk concentrated by freezing out the water, the whole being agitated and stirred so that the ice forms in loose crystals, after which the concentrated milk is separated by centrifugal force; steam may be momentarily projected against the ice until free from adhering milk. The process is repeated until the product contains from 80 to 95 per cent of solids. It is then sterilized by passing over the surface of a freezing cylinder cooled to —10° to —20° F., glycerin being employed to transmit the cold. The frozen milk is further concentrated in vacuum pans heated to 100° F.; the vacuum is then broken by admitting carbonic acid instead of air, to prevent oxidation. The warm semi-solid product is run into moulds.

The composition of the milk can be altered by addition of a sterilized sugar solution to the milk when in the vacuum pans. After concentration to a semi-solid state, cream (sterilized by cold) is added, so as to give a product containing 10 to 25 per cent of milk fat.

The blocks of concentrated milk are cut into chips, placed on trays, and dried in carbonic acid heated at 100° F.; the material is then cooled to 32° F. and ground in mills worked at 32° F. The powder is preserved in hermetically sealed jars containing carbonic acid.

Partially concentrated milk may be drawn off from the vacuum pans and filled into jars in presence of carbonic acid; it then resembles ordinary condensed milk.

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THE ACETYLENE GAS EXHIBIT AT THE ATLANTA EXPOSITION.

The word carbide is used in chemistry to designate the combination of an element with carbon, and in cast iron and steel examples of such compounds may be found. The first production of a combination of carbon with an alkaline metal is due to Sir Humphry Davy, and since his time various carbides of this type have been produced experimentally. The alkaline and alkali earth carbides, such as calcium carbide, ave a distinguishing characteristic in being decomposed by water with the evolution of acetylene gas, itself a hydrocarbon of extraordinarily high value as an illuminant. The production on the large scale of calcium carbide to be used for the manufacture of acetylene gas is now being carried out at the works of the Wilson Aluminum Company, of Spray, N. C. By heating in an electric furnace a mixture of lime and carbon a combination of the two substances ensues, and a stone like material, the calcium carbide, is produced. When water comes in contact with it, part of the hydrogen of the water combines with the carbon, forming acetylene; the rest of the hydrogen, with the oxygen of the water, combines with the calcium, forming calcium hydrate.

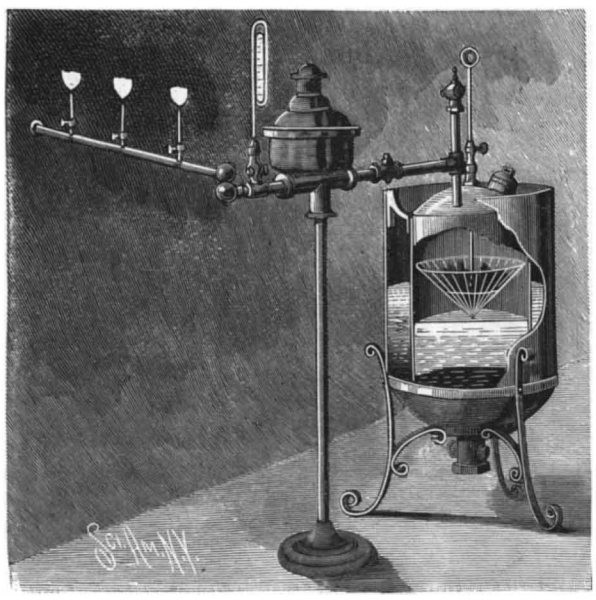
The subject has been already treated in considerable detail in our SUPPLEMENT, and no recent achievement in the technical world has attracted as much attention from the public as this one. The practical synthesis of carbon and hydrogen has long been a dream with the chemist, and its accomplishment on the small scale in the laboratory has represented one of the triumphs of chemistry.

The commercial synthesis of carbon and hydrogen as exemplified by acetylene gas formed one of the most striking exhibits at the Atlanta Exposition and is illustrated by us. For there not only was the calcium carbide and products of the electric furnaces at Spray, N. C., to be seen, but the gas was shown in practical shape, produced from a portable and compact evolution apparatus and also as burned directly from compression cylinders in which it was stored in liquid form. The gas was burned from open burners and in different types of car lamps, one of its prospective uses being the lighting of railroad trains.

In the foreground of the larger cut the direct evolution apparatus is shown in operation, while its section is given in the smaller cut. This apparatus is of the type of the familiar hydrogen gas generator of the chemist. In all such apparatus for the production of acetylene due regard has to be had to the extraordinary rapidity of evolution, comparable only to the evolution of carbon dioxide gas from sodium bicarbonate and acid. In the outer casing, which is about one-half filled with water, a fixed bell or receiver is inverted, whose lower lip reaches to within a short distance of the bottom of the containing vessel. A rod passes through the top of the receiver, the joint being made gastight by a stuffing box, so that the rod can be pushed up and down. To the lower end of the rod a conical wire basket is secured. From the top of the receiver a tube passes off to conduct the gas to the burners, and a hole with tightly fitting screw stopper is provided in the top for the introduction of calcium carbide.

The apparatus is on exactly the lines of the experimental one illustrated in the SCIENTIFIC AMERICAN of March 30, 1895. As the water comes in contact with the calcium carbide in the basket, acetylene gas is generated. This forces the water down and out of contact with the carbide, and gas is no longer evolved. If any gas is drawn off, the water rises, again reaches the carbide and evolves more gas. Thus a constant supply can be taken from the apparatus. As the carbide becomes decomposed the calcium hydrate resulting from the decomposition falls through the basket to the bottom of the water, and the fresh material keeps descending to the point of the basket. Thus an approximately constant water level and pressure is maintained. When more carbide is to be added, the apparatus is opened at the top for its introduction, and the evolution of gas must cease for the time. To insure a constant pressure a gas governor is mounted on the delivery tube and a pressure gage enables the pressure to be watched.

In the background of the large illustration are shown



SECTION OF GAS EVOLUTION APPARATUS.

the compression cylinders as arranged for household uses. The steel cylinders are 3 feet 10 inches in height and 5 inches in diameter. They are mounted on a reducing valve or high pressure governor whose case forms a base for the cylinder to rest on. From the base the delivery pipe rises, and is carried to the burners.

The effectiveness of the liquefied gas can be determined from the following considerations. One volume of the liquid gives at 64° F. 400 volumes of gas, and for the supply of a single burner from ¼ to ½ a cubic foot per hour is sufficient. A common gas burner uses 5 to 8 cubic feet per hour. It is therefore a fair average to take 70 cubic feet of acetylene gas as the equivalent of 1,000 cubic feet of ordinary gas. This 70 cubic feet would be yielded by about 300 cubic inches of the liquid.

There is one point in connection with the liquefaction of the gas which might be the occasion of some difficulty. The critical point is put at 98·69° F., about 10° above that of carbon dioxide. If this is correct, acetylene would cease to be a liquid above that temperature and the conditions of its storage in cylinders might be considerably modified.

ACETYLENE GAS EXHIBIT AT THE ATLANTA EXPOSITION.

Auriferous Beach Mining in Australia.

A considerable portion of the New South Wales coast, north of Newcastle, is largely auriferous, and for many years numbers of people have been regularly employed in extracting gold from the sand, both from the beaches and from the natural terraces at their back, the principal scene of operations being confined to that portion of the coast between the Clarence and Tweed Rivers. Gold is found on other parts of the coast, both north and south of Sydney, but rarely in payable quantities. The beach miners appear to derive a comfortable living from their labors, but the exact amount of metal cannot be ascertained, because a considerable portion of the miners have a migratory tendency, not remaining long in one place; consequently many parcels of amalgam are taken elsewhere and included in the returns from other districts. The Sydney mint returns show, however, that something like 3,400 oz. were received during 1894 from the coast between Byron Bay and Iluka. The gold on the beaches is more plentiful after violent storms, and at such times the miners are actively employed. The busiest scene is perhaps that afforded by the Seven Mile Beach, near Byron Bay, where, according to a recent visitor, many men are engaged on a line of reef at low tide, scooping up the black sand from the crevices in the rocks, from which they generally obtain good returns, an instance being recorded of a party of miners on this part of the coast clearing £700 per man in a few months. This, of course, was an exceptional return. Considerable discussion has taken place respecting the probable source of the gold, but nothing definite has been ascertained. The local opinion is that it is washed up from auriferous beds at the bottom of the sea. The gold-saving appliances used are generally of a somewhat primitive character, the returns not being sufficiently large to encourage the introduction of costly machinery. One peculiar feature of beach mining is that, as a rule, where the black sand is deepest the gold is least plentiful. In the vicinity of the Macleay Heads there are veins of black sand from 2 to 6 feet in thickness, but these contain only slight indications of gold. The best returns have been obtained during exceptionally low tides, when the masses of submerged rock can be approached, and the black sand in the holes and crevices extracted. The plates often require different modes of treatment, according to the locality from which the sand is obtained. In preparing the plates cyanide of potassium is used to a large extent, and in many instances the concentrates have to undergo a separate treatment before finally passing over the plates, especially where traces of coated gold are perceptible.—Engineering and Mining Journal.

Angling by Electric Light.

One evening recently two anglers, one a resident of Newhaven, tried the interesting experiment of fishing in Seaford Bay by electric light. A fisherman of Newhaven rowed the anglers from the railway pier soon after six o'clock, when it was completely dark. A portable battery with a 5 candle power incandescent lamp was taken, and this lamp was lowered until a weight below it touched the bottom at 25 feet. Both battery and lamp were specially made for the trial, and the lamp was protected by a galvanized crinoline and was made watertight. When it reached the bottom of the sea, there was, it is stated, a circular area, 20 yards in diameter, brightly illuminated right up to the surface. Fishing was carried on with an ordinary line on the port side, the lamp having been lowered on the starboard side of the boat.

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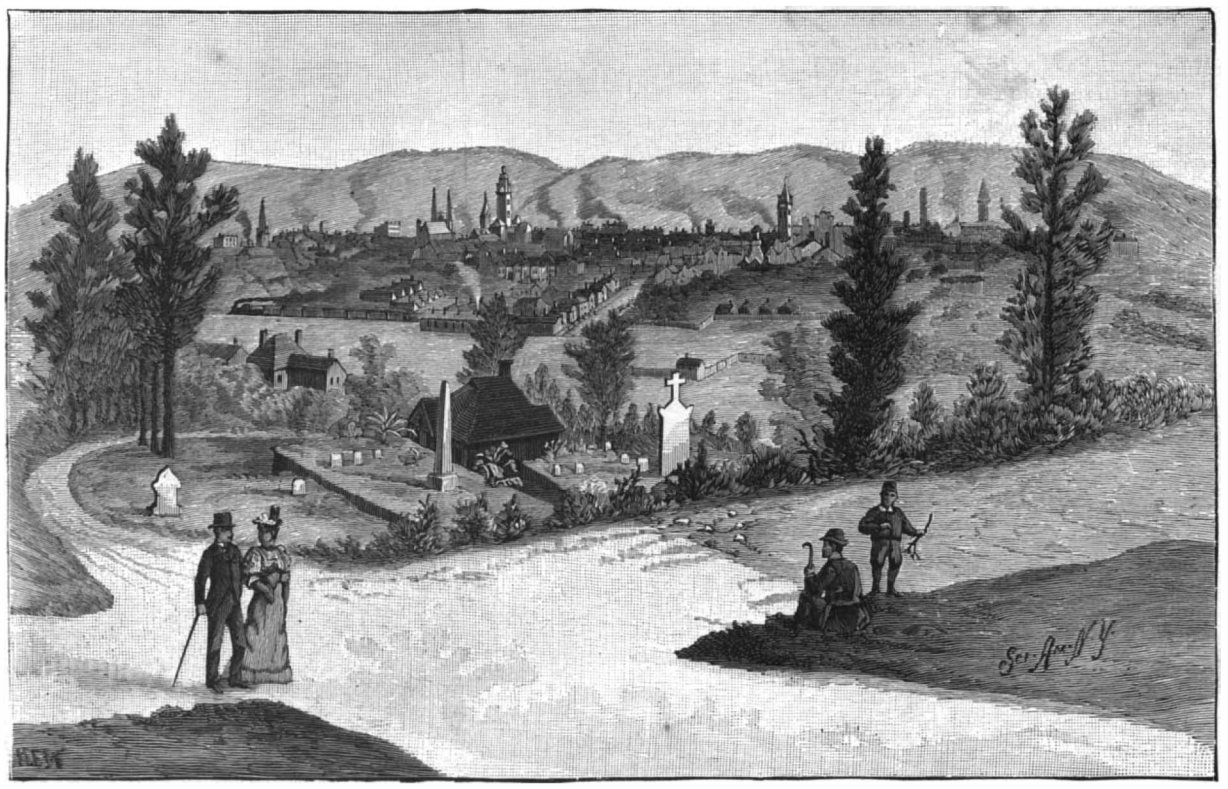
THE IRON INDUSTRIES OF BIRMINGHAM, ALA.

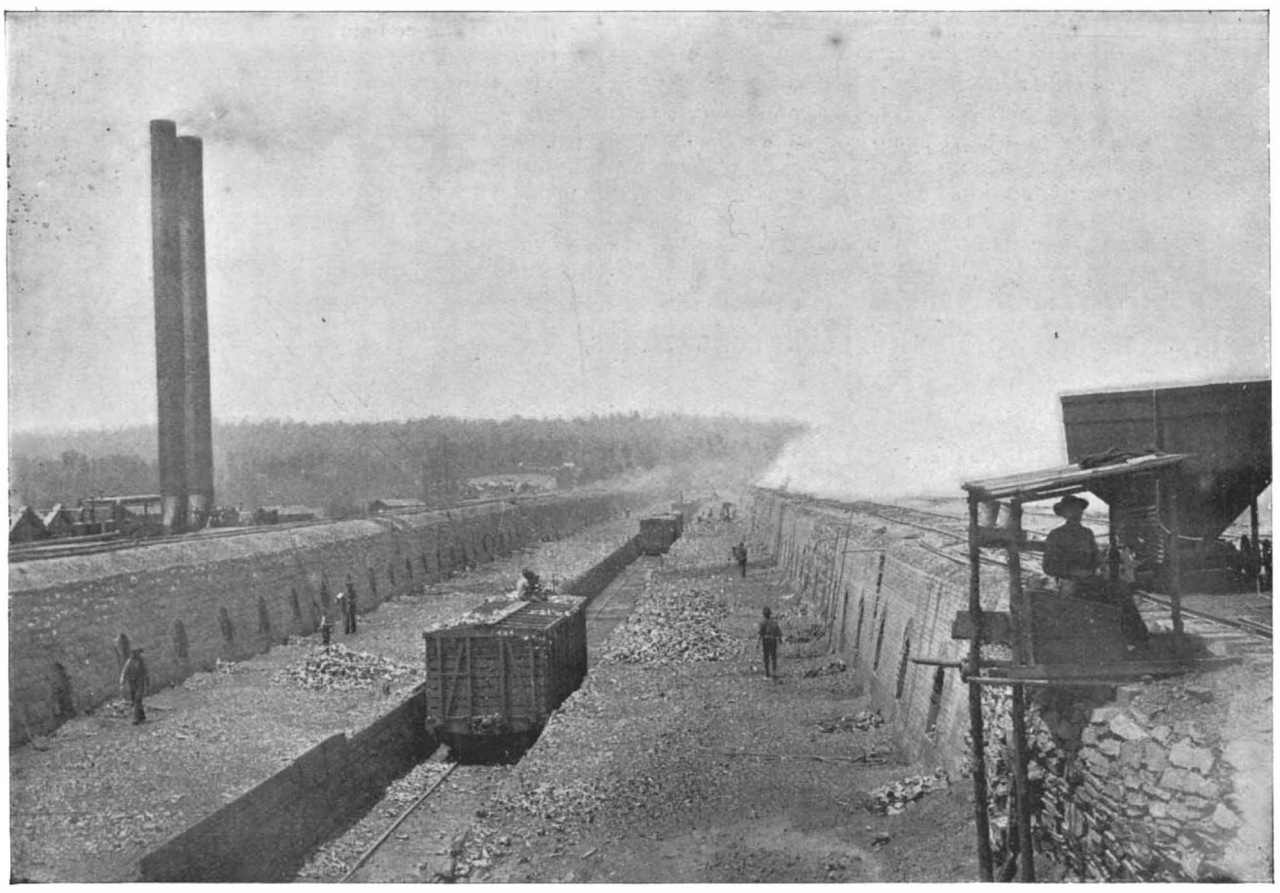
In a recent visit to the Exposition in Atlanta the attention of our correspondent was called to a specimen of red iron ore in the Alabama building. It was in the form of a monolithic column, twenty-two feet high, and was said to represent in its height the thickness of the vein of ore in the Birmingham, Ala., district from which it was taken. Naturally such an exhibit arrests the attention of the iron-working community and inspires the spectator to know more of this iron wonderland. It was in pursuit of more knowledge of this subject that led the writer to visit Birmingham, and he was enabled thereby to procure some illustrations from recent photographs taken of interesting features of the place and its industries.

When it is seen that such vast stores of iron are concentrated in so accessible a location as Birmingham, with its network of railways diverging to all points of the country, the reflection comes, What effect can this profusion have upon less favored fields?

The earliest workers in iron, the Phœnicians, producing small quantities, with abundant timber at hand for producing the charcoal fuel, did make iron that excelled in quality for the purposes for which wrought iron was useful. It can be said truthfully that the ores of Birmingham, with coal and coke as the reducing fuel, are also capable of producing a superior wrought iron for all commercial and mechanical purposes. The demands of the present day, however, have a wider field, in the various grades of steel and malleable iron work; and it is essential that certain conditions shall exist in the metal used for these purposes.



GENERAL VIEW OF BIRMINGHAM ALA.



PLATT MINE COKE OVENS.

Our present purpose is to show some of the plants erected for the reduction of the ores, and other views connected with the iron industry.

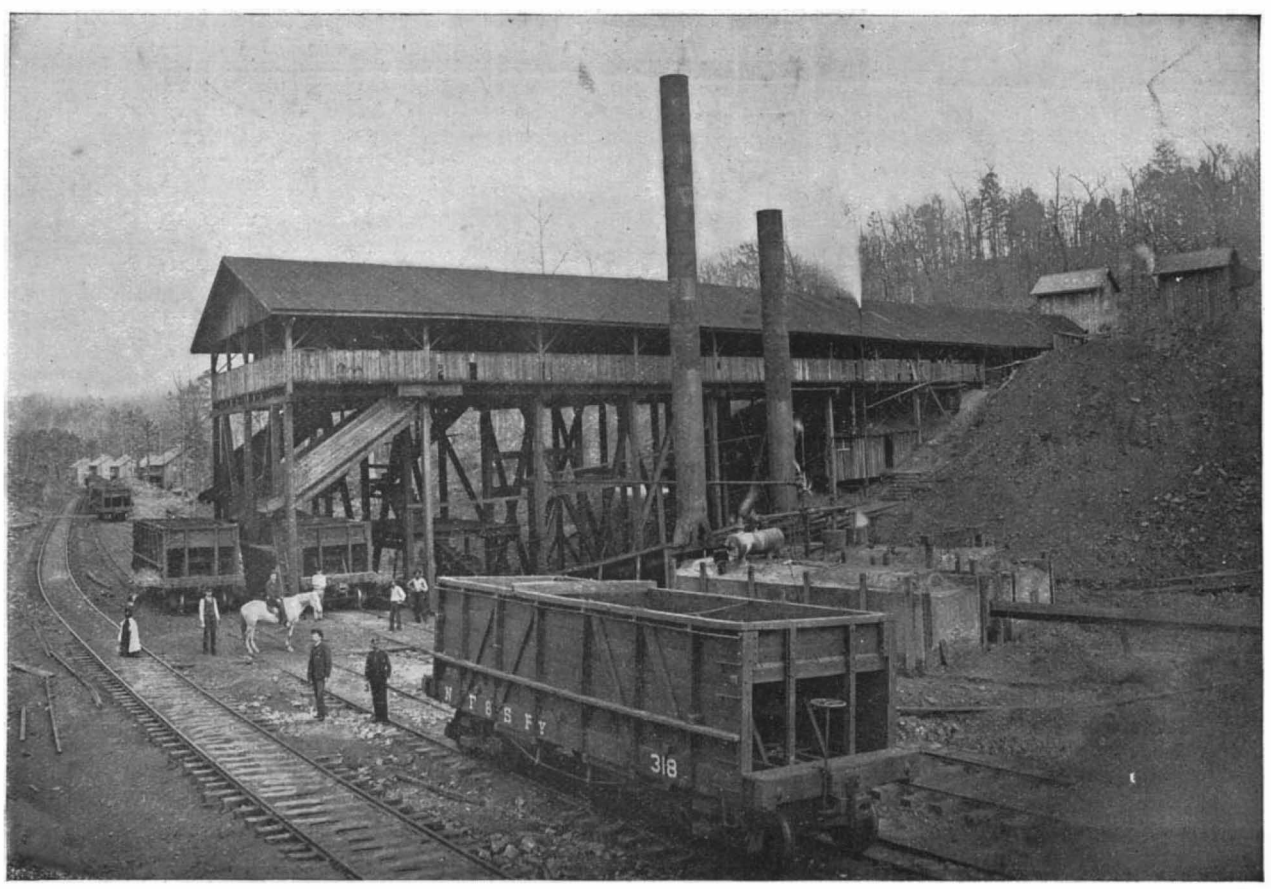
The city of Birmingham, the center of the iron district, is most beautifully located upon an eminence in a broad valley between two ranges of mountains.

Our sketch of the city was taken by our artist from the northerly one of these mountains, on the slope of which is located the principal cemetery of the city. Over the city itself is seen the southerly range, which is called Red Mountain, and it is from this range that most of the iron ore, coal and limestone are obtained.

The city contains a population of over 30,000 inhabitants, has wide, paved streets, rows of fine business structures, hotels, fine churches, schools, street cars, and its people have much social refinement and talents for arts other than that of iron production. In this district, of which Birmingham is the center, are 22 furnaces. Their names and number of furnaces are: Thomas, 2; Alice, 2; Sloss, 4; Ensley, 4; Woodward, 2; Bessemer, 5; Ox Moor, 2; Williamson (not in operation now), 1. Besides these are a large rolling mill and puddling plant, producing merchantable bar and round wrought irons, and associate industries. One of these is the producing of coke for blast furnace purposes. An excellent view of the coking ovens of the Platt mines is shown in one of the views. The beauty of a night view of this industry is familiar to every traveler in the vicinity of an iron district. In this view are shown the rows of ovens, in which the superabundance of the bituminous element and impurities are eliminated by charring. Raw bituminous coal is prone to cake and clog up the charge in the furnace, and besides this, elements other than pure carbon are driven off by coking, and the fuel brought nearer to that most perfect of fuels for smelting, wood charcoal.

The coal used is brought from the mines, in drifts with the mountain side, and run in chutes down into cars as shown in our view at the Sumter coal mine, on Blue Creek. Where the coal lies deeper in the earth and requires power to bring it to the surface, it is necessary to use cables from hoisting engines for this purpose. We show in a view the engine house and machinery used at Henryellen coal mines, in the Birmingham district. This photo clearly shows its operations, with the winding drums in the background, from which lead cables to the mines below, and which are rotated by the engines shown in the front.

The view of the Ishkooda ore mine has been selected as exhibiting the magnitude of the ore deposits in the Birmingham district. This interesting view shows the portion worked, of a solid vein of red fossiliferous iron ore, in which vein there is a thickness of thirty feet, varying but slightly from these figures, though the "working" shown was for special reasons located at the twenty-foot depth. The massive column showing in the front is a solid block of iron ore. As a representative type of the blast furnaces in this



SUMTER COAL MINE, BLUE CREEK NEAR BIRMINGHAM.

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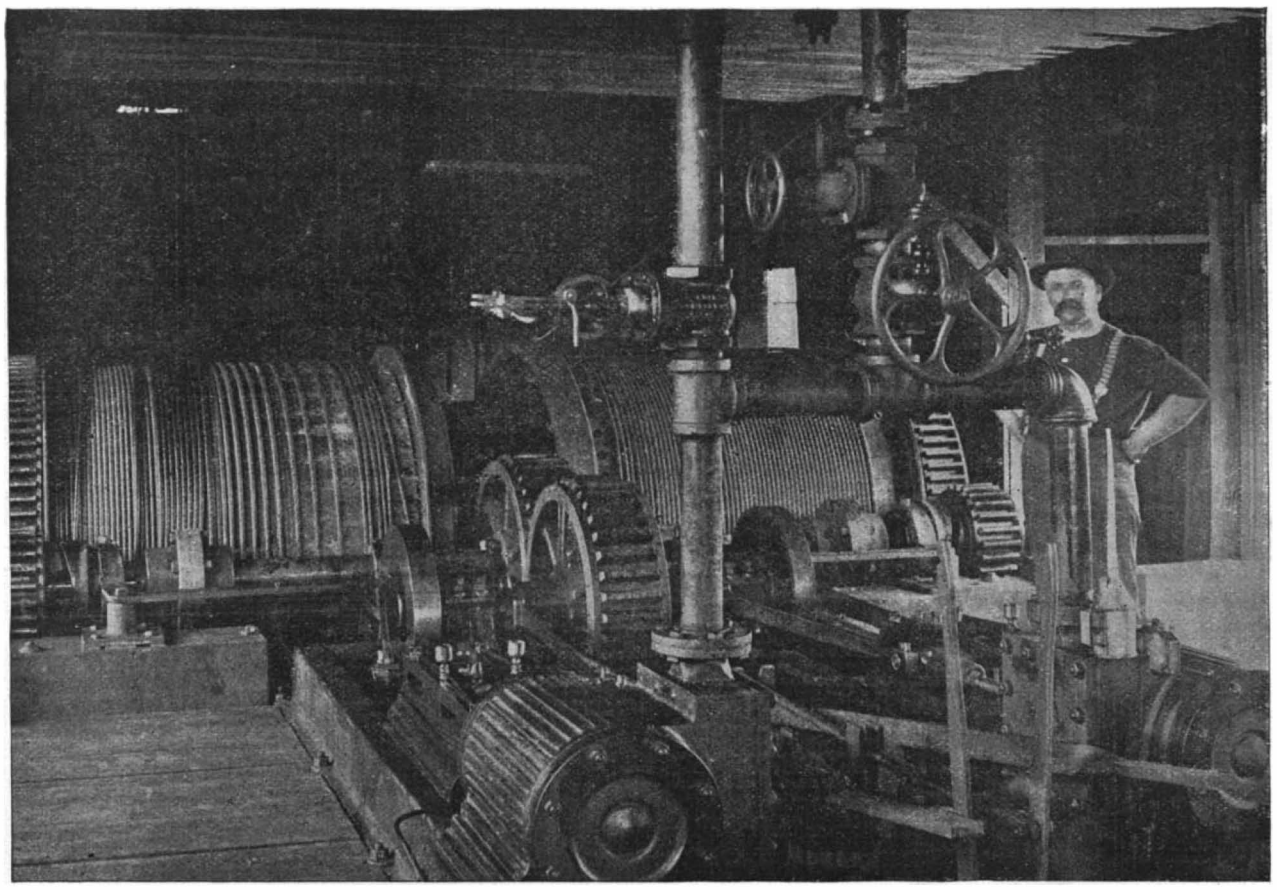
district a view of the Ensley furnaces is shown, having four furnaces or stacks in the plant. The working of one of these huge furnaces will be described in a future issue, together with some notes on the great industries which have been built up in Birmingham in so short a time.

Long Distance Signaling.

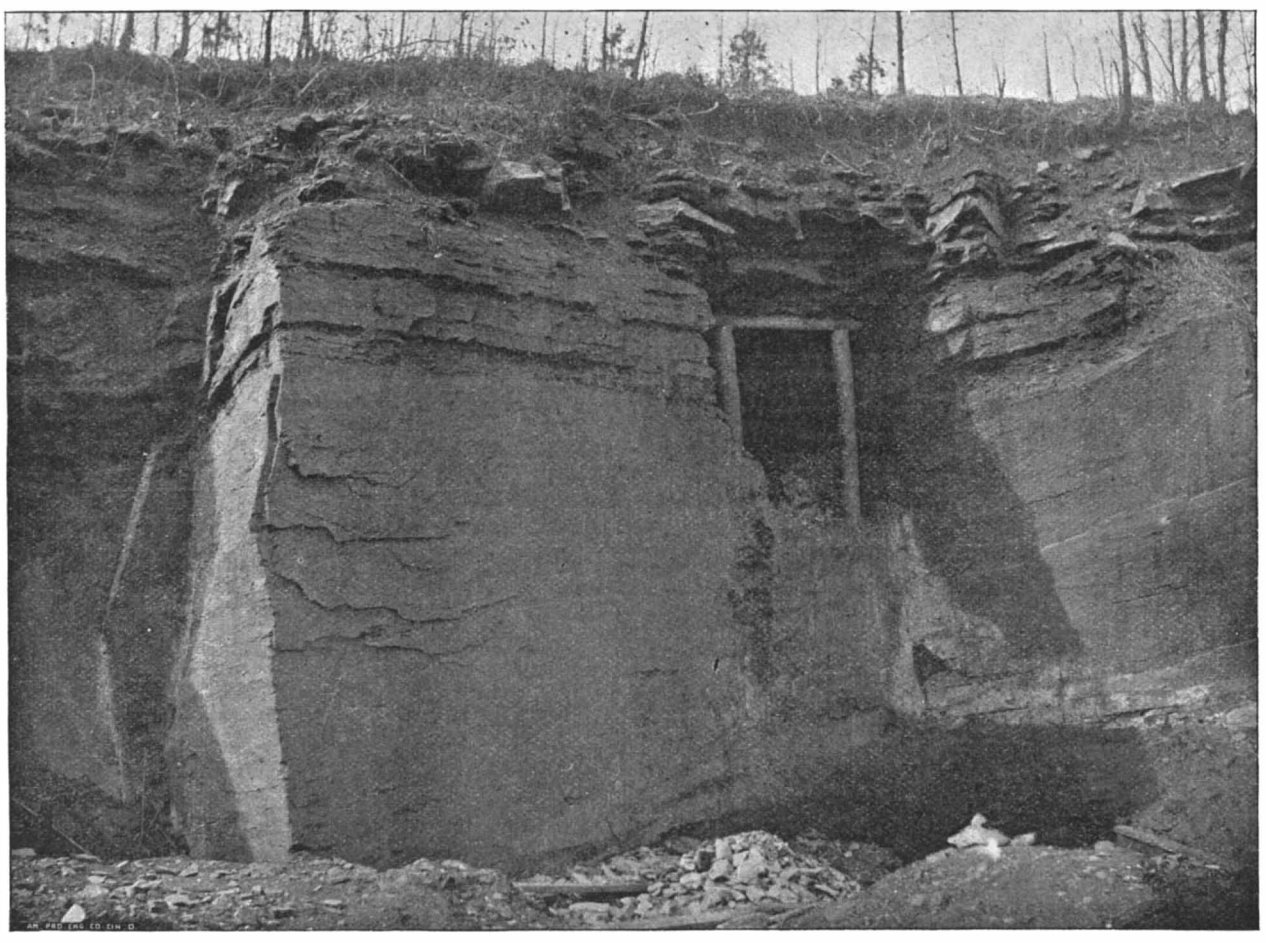
In his annual report, Captain W. A. Glassford, Chief Signal Officer, Department of Colorado, enters at length into the subject of military signaling over long distances.

Successful heliographing was accomplished over ranges from 20 to 85 miles in length by signal parties from posts; and ranges of 125 miles will be undertaken during the coming year. Such, indeed, has been the interest in the heliograph that ranges have been tried until now there is but one intervening range to be tested in order to complete, should it be necessary, a plexus of heliograph stations to connect every post in Colorado, Utah, Arizona, and New Mexico with the Department Headquarters in Denver. In the preliminary long range practice between Pike's Peak and Denver, Col., the flash from Pike's Peak could be seen with the naked eye, and this signaling was interestedly witnessed by a number of spectators; among others General McCook was a pleased observer of this preliminary work, and it was only then that the possibility of heliographing over the 183 mile range ceased to be considered by many as chimerical.

The conclusion arrived at from this experience in long range signaling is, that under the conditions of sunlight or clearness that obtain in this Western region, with a mirror of sufficient surface area, with some modifications of manipulation, these ranges are only limited by the curvature of the earth and intervening mountains, and are as practicable as the shorter ones. It is not tenable, however, to claim for such long distance heliographing signaling that it is always to be relied upon, or that it is a practicable means of military communication under all circumstances; but for that matter, the heliograph is never to be wholly depended on, because, even in short ranges, clouds may intervene in some cases for a long time. A system of repeating signals is accordingly suggested. Words deciphered in one message can be recorded, and others added to it from the repetitions until the whole message is received.



ENGINE HOUSE AT HENRYELLEN COAL MINES.



ISHKOODA ORE MINE.

THE following lines have been engraved upon Huxley's tombstone:

"And if there be no meeting past the grave,
If all is darkness, silence, yet 'tis rest,
Be not afraid, ye waiting hearts that weep!
For God still giveth his beloved sleep,
And if an endless sleep he wills, so best!"

Work of Life Savers.

According to the report of the General Superintendent of the Life Saving Service for the fiscal year ended June 30 last, the number of disasters to documented vessels within the field of the operations of the service during the year was 483. There were on board these vessels 5,402 persons, of whom 5,382 were saved and twenty lost. Eight hundred and three shipwrecked persons received succor in the stations, to whom 2,232 days' relief in the aggregate was afforded.

The estimated values of the vessels involved was $8,001,275, and that of their cargoes $2,645,960, making a total value of property imperiled $10,647,235. Of this amount, $9,145,085 was saved and $1,502,150 lost. The number of vessels totally lost was seventy-three

In addition there were 192 casualties to small craft, on board of which were 421 persons, of whom 415 were saved. Life saving crews also rescued 110 persons who had fallen from wharves, piers, etc.

The crews saved and assisted in saving 379 vessels, valued with their cargoes at $3,561,665, and rendered assistance of minor importance to 181 other vessels in distress, besides warning from danger by signals of patrolmen 249 vessels. The cost of maintaining the service for the year was $1,345,324.40.

The Petrified Trees of Arizona.

At a recent meeting of the New York Academy of Sciences a paper on Some Features of the Arizona Plateau was read by L. S. Griswold.

In general the plateau surface is between 5,000 and 7,000 feet in elevation above sea level and strikes one as being remarkably smooth for so high elevation; there are large stretches of nearly level or gently rolling country, diversified, however, by mesas and outliers with escarpments rising between 50 and 200 feet, shallow but broad old stream channels now little used and leading to cañons with precipitous walls. On the plateau top are numerous volcanic elevations, varying in age from the young cinder cone to the denuded stock. Over the district silicified wood is well known, occurring at the base of a gravel and sand horizon, little consolidated, belonging to the late Tertiary or Pleistocene times, and lying with slight unconformity in part upon probable Triassic strata and in part upon Carboniferous, the older formations being little disturbed.

The trees now petrified originally grew to large size, eight or nine feet in diameter for the largest, probably conifers, and perhaps not very different from the forest growth of part of the present plateau. This ancient forest was apparently thrown down by the wind, for tree butts are common in horizontal position while only one was found erect. The gravel and sand covering would seem to have come soon, for only a few have fillings of sediment in hollows or give other indications of decay; the logs were buried at least fifty or sixty feet deep. The weight of the overlying sediments crushed the trees so that the horizontal diameters are commonly greater than the vertical as they are seen in place. Silicification was probably accomplished by percolating surface waters, as the logs are distant from volcanic vents, as far as known to the writer; then no hot water deposits were seen accompanying the logs, and the distribution as seen over many miles and reported much more widely would also militate against the theory of change by hot waters.

The Lava of Idaho.

Ages ago a vast river of fire poured down the center of the State of Idaho. This river consisted of molten lava, was 400 miles long, 100 miles wide, and from 300 to 900 feet thick. Across the corpse of this mighty river of fire a river of water has slowly cut a channel in several places. Born in the melting snow of the majestic Tetons, this river has cut its way for hundreds of miles through lava beds, in its course tumbling over numerous precipices until the great climax is reached at Shoshone Falls, where this mighty river makes an awful leap of 210 feet, a magnificent spectacle, in marked contrast to the desolate country on either side.

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The Hermit of Moose Island.

Uncle John Cusack, the hermit of Moose Island, has just sold part of his insular domain in Moosehead Lake, and, to this extent, has abdicated the long seclusion in which he has dwelt for about 30 years. He retains 200 acres, upon which his house and stable stand. Four hundred acres he has sold to a wealthy woman, said to be a Southerner, for about $4,000, who will build there her summer residence.

It was near the close of the civil war that John Cusack, now a hale and hearty man of 65 years, came from Reedfield, Me., and pitched his camp upon Moose Island, which subsequently he bought. He was a man of intelligence and some education who had studied law. Here he worked for various lumber firms that operated about the head water of Maine's great rivers in the Moosehead Lake region. Energetic, industrious and temperate, he became famous on the west branch of the Penobscot for his wonderful skill in log riding, a proficiency exercised to great advantage in getting the log drives down the broken waters of that swift and turbulent stream.

Not long ago there appeared in print an account of John Cusack's feat in crossing the Piscataquis River at Foxcroft, standing on a 35 pound binding pole. Such a performance is a commonplace one for him. Frequently, on a wager or merely to exhibit his skill, he has crossed the broad reach of West Cove at the foot of Moosehead Lake, on a pole as slender, and even when upheld by nothing more buoying than a lumberman's pick-pole. As to the matter of a boat to take him from his island to the mainland he gives himself little trouble. To leap upon a log, with a slab or sapling for paddle, propel himself across the dividing channel, is as much a matter of course with him as for an urban resident to step upon a horse car.

With such a craft he sometimes has made strange and adventurous voyages. Once as the steamer from Kineo plowed down the lake through a heavy sea, the ship's company were astounded by the sight of a man, in mid-lake, standing breast high in the heaving waters, with which he was battling in seeming pursuit of a small dog that sat in full view above the surface a few feet ahead of him. The steamer, changing her course, slowed down to pick up John Cusack, who was making the fourth mile of a voyage with an old tree root as his craft and his dog as passenger. He stood upon the larger end of the root, thereby lifting the other end above the water, and upon this upraised tip the dog found a safe if not quite dry footing. The sight of Uncle John and his dog making similar though less venturesome voyages about the lower part of the lake is not uncommon, and the dog has learned to take his place on the dry end of the stick or root at his master's first word of command.

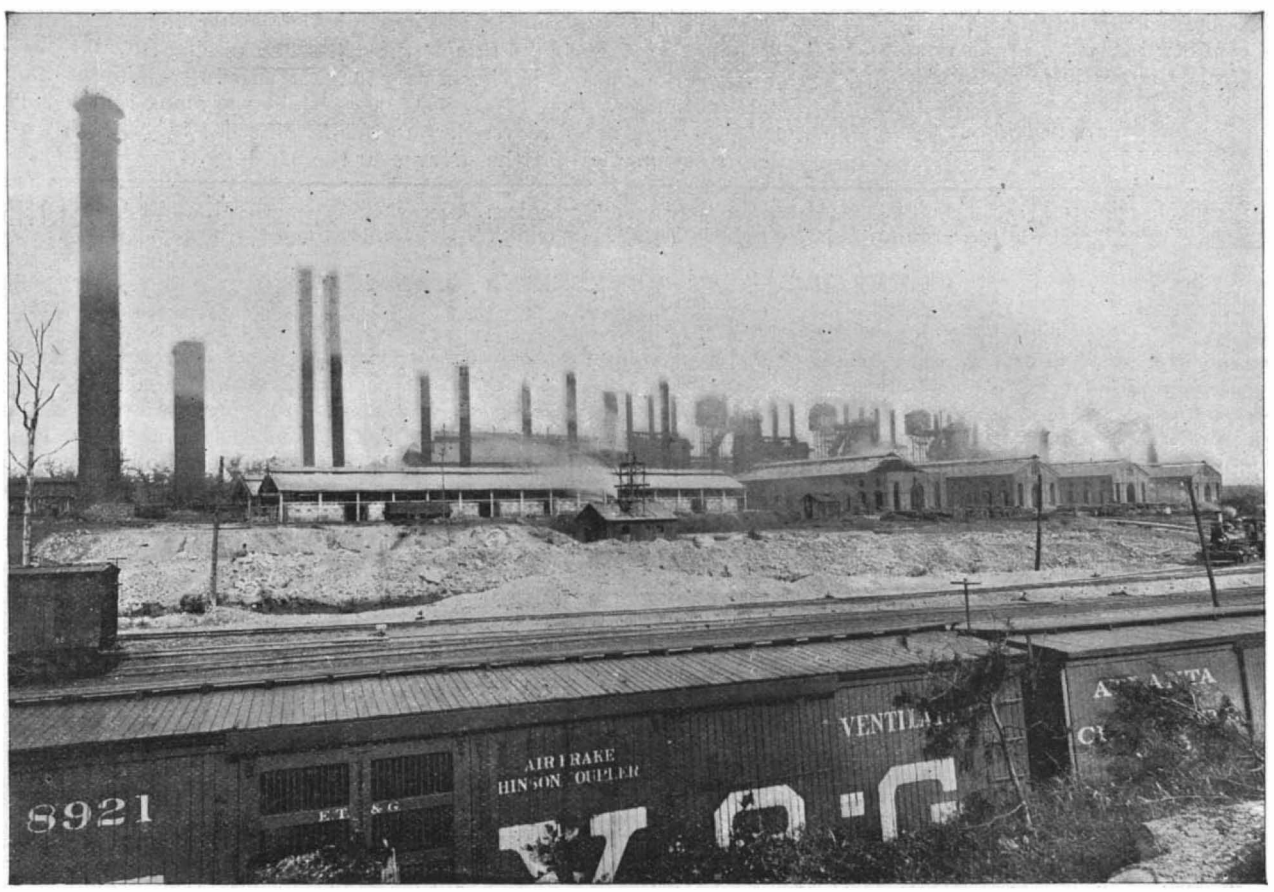
In his primitive castle on Moose Island, John Cusack lives on terms as patriarchal and friendly with the dumb animals which are his companions as did Robinson Crusoe with his goats. In the summer his sleek oxen, sheep and poultry forage well for themselves over the slopes and fertile meadows of the island. In the winter, should it chance that John Cusack desires to go away to remain for several days, he does not trouble himself to import a man to care for these creatures. He pitches half a ton of hay down into the middle of the barn floor, scatters corn and grain around where the hens can get to it, opens the barn door so that they can go to the spring for water at pleasure, and goes away for an indefinite time with assured confidence that all will be well at home.

Despite his secluded and celibate life—Uncle John is a bachelor—he has no aversion to human society, but, on the contrary, enjoys it, and he is especially gallant and chivalrous to the fair sex. In the solitude of Moose Island he doesn't find much of a field for conversation, but he makes full amends when he emerges, as he often does, into the settled communities. Then, by the stove of a country store or a hotel office, he can talk a continuous streak, without pause for rest or refreshment, for six hours at a stretch, and then stop when time at last is called as fresh and colloquial as at the beginning.

In person the hermit of Moose Island is short and active of motion, and his hair and full beard are now sprinkled with gray. He dresses neatly, but on his island domain he is prone to discard the use of shoes and stockings as a needless conventionality, and it is a cold day when he takes the trouble to don footwear for an informal trip to Greenville, the nearest base of supplies.—Maine State Press.

Our Export Trade.

A notable feature of our export trade in recent months, the Boston Journal of Commerce says, has been the widening of the markets for American manufactures. Thus this fall $100,000 worth of American cotton fabrics have been sent to Arabia, while Roumania, Turkey, and Spain have placed trial orders for hardware. Russia has bought very large lines of American manufactured rubber. Brazil has placed large orders for chemicals of American manufacture. France bought American bicycles to the value of $12,000 this autumn, while the United States of Colombia purchased $8,000 worth of American "wheels." South and Central American countries have bought large quantities of American cutlery. The Argentine Republic took $60,000 worth of binding twine. Electrical material is in demand in Brazil, which, between August 1 and October 1, placed orders for more than $30,000 worth of it in the United States. Australia favors American carriages, and has bought many this autumn. South Africa is a very large purchaser of American manufactures, notably of agricultural implements, machinery, trunks and bags. There has been a large increase in the exportation of agricultural implements this fall, Argentina taking them to the value of $270,000, while Uruguay's purchases footed up $52,000. England is the largest purchaser of our manufactured goods, especially of those that may be called "Yankee inventions." The Australian colonies have recently expended $60,000 for American paper and paper goods. The exports above mentioned, it should be said, are those from the port of New York alone, and other ports will considerably swell the total of our shipments to foreign nations.



ENSLEY FURNACES.

Tree Ages.

Gericke, the great German forester, writes that the greatest ages to which trees in Germany are positively known to have lived are from 500 to 570 years. For instance the pine in Bohemia and the pine in Norway and Sweden have lived to the latter age. Next comes the silver fir, which in the Bohemian forests has stood and thrived for upward of 400 years. In Bavaria the larch has reached the age of 275 years. Of foliage trees, the oak appears to have survived the longest. The best example is the evergreen oak at Aschoffenburg, which reached the age of 410 years. Other oaks in Germany have lived to be from 315 to 320 years old. At Aschoffenburg the red beech has lived to the age of 245 years, and at other points to the age of 225 years. Of other trees, the highest known are ash 170 years, birch 160 to 200 years, aspen 220 years, mountain maple 225 years, elm 130 years and red alder 145 years.

Industrious Leeds.

At the recent annual meeting of the Society of Chemical Industry at Leeds, Mayor Gilston delivered himself after this fashion:

I am not going to make any comparisons between the industries of Leeds and other places, because it would be to their disadvantage. There are some places that are noted for one thing, and they live and sometimes thrive by it. Leeds, I am glad to say, is dependent on no one industry. I daresay it would take Mr. Jackson and myself all our time to tell you to-night which is the staple trade of Leeds. We not only make cloth, but we have one firm that can supply 10,000 suits of clothes in a single week. That does something to clothe humanity, whether it betters it or not. The variety of our industries, to my mind, is but an evidence of the versatility of the genius of our people. I sometimes say London is what we have made it and that it could not exist without us; for whenever we have a man who seems to rise above the common herd, he is taken to London. Even when we had made Professor Thorpe what he is, they would not let him remain; they took him to London that he might raise the standard of intelligence of the people there. That is no uncommon practice with Leeds people. In the leather industry I believe we are second to none. We not only make the leather, but we supply all creation with shoes. People go so far as to say that by means of recent discoveries the hides of cattle bought in our markets on Wednesday and taken to Mr. Jackson's, on Friday night reappear as ladies' shoes. You have seen through the steam plow works. We have supplied creation with the means of husbandry. You have seen Greenwood & Batleys, where we can destroy creation with almost equal ease. I have no fear as to the future of this country, if genius, skill, perseverance, and intelligence are allowed fair play in the development of our industries. We have not only iron, machinery, flax, cloth, linen, glass, and porcelain works, but we have an industry in this town unknown almost to you. I daresay not many know that Leeds is a wine-producing center; but you might have had your suspicions raised if if you had gone round and seen the fields of rhubarb we cultivate. By the railway over which Mr. Jackson so ably presides it is no uncommon thing to send out 250 to 300 tons of rhubarb in a single month to be made into wine. It was worth coming to Leeds to know that. But to my mind the great aim and object of the society is not to lessen the means of production, nor the amount of employment for our artisan population, but it is to economize and recover what has been hitherto waste material. This will not only have to be taught in our colleges but put into practice in our workshops. I was through a large chemical works a short time ago and saw a great pile of refuse from the making of alkali. When I was a boy I saw that heap being piled up, wagon after wagon, as a nuisance because it occupied useful ground. What did I find the other day? After it had lain there for sixty years they are working that heap over again and converting it into sulphuric acid. This is one of the provinces of chemistry. We have been making useful what has been useless. We are making profitable that which was unprofitable in the past, and Leeds, from its great variety of industries and the skill and intelligence and frugality of its people, is in the van of progress. When you, gentlemen, have taught us how to utilize the carbon we send out of our chimneys, the produce of our labor will be less costly and the atmosphere purer. I am satisfied that England has not yet arrived at her greatest development, and if English skill is left "free" from fetters of an artificial kind, I will back England against creation in her manufactures.

A CONCESSION to build a carriage road from Teheran to Bagdad and also to build electric railroads in the suburbs of Teheran has just been granted to a German contractor.

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Typhoid Fever Disseminated Through the Milk Supply.*

The relation of milk to the spread of infectious diseases has been most strikingly shown in an epidemic of typhoid fever that occurred at Stamford, Conn., during this year, the official report of which has been recently issued by Professor H. E. Smith. The evidence gathered shows beyond all question that the disease was propagated by means of the milk supply, so that the epidemic possesses unusual interest for students in bacteriology and hygiene.

The epidemic broke out in April, and within six weeks 386 cases were reported in a town of about 16,000 inhabitants. Of this number, 65 cases or 16·8 per cent were five years old or under, while over one-third of the total number were under ten years of age.

The mortality statistics of the State of Connecticut for the last 15 years show that less than 10 per cent of the total number of deaths from typhoid have been under 10 years of age. In view of this, the large number of cases in early childhood has a peculiar significance in explaining the origin of the epidemic, as the infection of the milk supply would be more apt to manifest itself in infants than in adults. As soon as the milk supply was suspected, its sale was prohibited, and in fifteen days (about the usual period of incubation of this disease) after this prohibition went into effect the number of new cases dropped from an average of over ten a day to less than two. It was further shown that out of the total number of 386 cases, 352 or 91·2 per cent lived in families that were supplied with milk from the same dealer. In 14 other cases milk from this same dealer was consumed by parties at a cafe and bakery. In 8 of the remaining cases milk was supplied the parties by the producer from whom the milk peddler obtained his supply. This makes a total of 97·1 per cent of all cases that received the milk, either directly from the producer or indirectly through the milk dealer who peddled the milk. As the milkman in question only supplied about 9 per cent of the total amount used in the town, the number of cases that developed on his route is of especial interest.

The evidence of a contaminated milk supply was overwhelming, but how to account for the infection of the milk was not so easy. The milk might have become infected in the hands of either the dealer or the producer. Inasmuch as a few cases of the epidemic developed that were not supplied with milk from the dealer, but were supplied by other parties that had been using some of the milk cans in common with him, the presumption was strongly in favor of the view that the infection occurred while the milk was in the hands of the dealer. It seems that the dealer was in the habit of washing out his cans himself, and while he obtained most of his supply from the producer in question, at times he secured an extra supply from other parties. No particular attention was paid to the cans that were used, so that they were often mixed up and returned to different parties after they had been cleaned by the dealer.

No case of typhoid had occurred at the house of either the dealer or the producer, so that direct infection of the milk did not seem probable. An examination of the water supply was then made. At both places shallow wells were found, that of the milk dealer's being only thirteen feet deep with nearly twelve feet of water in it. The well was surrounded on several sides by privies, an extremely foul one being within twenty-five feet of the well. It was the habit of the dealer to first rinse out the milk cans with water from this well, then they were thoroughly cleansed with hot water and soda, and finally rinsed in cold water again that was taken from this well.

Both the bacteriological and chemical examination of water from the two wells was made.

Neither of the wells was good, and that of the milk dealer was grossly contaminated, having nearly 70,000 germs per cubic centimeter.

Typhoid bacteria were not discovered, but this is not surprising. It is possible that the privy near the well may have been used by some unknown person, as it was close to and easily accessible from a railroad. There is no positive evidence, however, that the water was contaminated except in the history of the epidemic. The evidence, however, is so strong that there can be no valid objection to the conclusion that milk was infected by washing the cans with contaminated water.

H. L. RUSSELL.

* From Science.

Torpedo Boat Practice at Newport, R. I.

Rules were arranged similar to those which have governed the drill between the torpedo station and the Cushing, except that Lieut. Smith promised not to take shelter behind any obstructions within 2,000 yards—one sea mile—despite the fact that the battleship Maine has four searchlights and should consequently be impregnable against a torpedo attack, if there is such a possibility with a reliance on searchlights alone, without other scouts.

The officers of the ship thought they were sure of success in such an attack, and in a harbor where they had but four narrow channels to sweep and a searchlight to each. But they were doomed to disappointment, as the torpedo boat had an easy task.

November 22.—The Cushing ran out to the ship in mid-harbor under running lights. After a brief conference these lights were hidden, and the Cushing sped off toward the channel. The searchlights swept the waters, but the boat was not to be seen. She had doubled her tracks, passed within 1,500 yards of the ship, and run out to sea. Then she glided up the channel, close under the Fort Adams shore, and then laid out a direct course for the ship. She was discovered only when within twenty seconds of torpedoing distance, and before all the lights could be trained upon her, to say nothing of an effective battery, she had discharged all three of her rockets. When the allotted two minutes had expired after her discovery she was alongside the ship. The second attack, while differing in method, was equally successful for the Cushing.

RECENTLY PATENTED INVENTIONS.

Agricultural.

PLANTER.—Anders Matson, Moline, Ill. This is especially a corn planter, automatically dropping corn at regular intervals, and the mechanism being adjustable to drop the corn in drills, one seed or as many as may be desired at a time. The markers are adjustable to large or small planting wheels, one marker marking the field one row in advance, and the marker on the opposite side of the machine traveling in the row previously marked, enabling the driver to readily see how to drive to plant the corn equal distances apart.

Electrical.

ELECTRIC DESK LAMP.—William H. Sheppard, New York City. This is an incandescent lamp admitting of three adjustments to shed light in different directions, having two swinging bracket arms in hollow trunnions projecting from the socket, the arms being revoluble to change the position of the light, while a cylindrical shade or drum may be revolved to alter the position of the light opening, the size of which may be adjusted by the drawing out, more or less, of a shutter. By means of a single key the current may be sent into either one or both of the lamps.

Miscellaneous.

FARE REGISTER.—Walter D. Campbell, Buenos Ayres, Argentine Republic. To insure the co-operation of passengers in observing the registering of the fares by the conductor, this invention provides an accurately registering mechanism in connection with a plainly visible dial, but the registering mechanism is so arranged that, after a certain number of fares has been registered, a prize or premium ticket will be thrown out, as, for instance, a small percentage of all the fares, the prize ticket becoming the property of the passenger paying the last fare.

WRAPPING PAPER PRINTING.—Byron J. Churchill, Morris, N. Y. To print upon rolls or spools of paper as it is drawn off for wrapping up parcels in stores, this inventor has devised a paper-supporting frame with which is combined a pivotally connected yoke and casing carrying an inking roller and a printing roller, the latter always remaining in contact with the paper and being rotated by frictional contact therewith, while springs keep the inking roller in contact with the printing roller.

THILL COUPLING.—Peter Bold, Woodbourne, N. Y. This is an improvement in couplings in which the opposite trunnions of the thill are received in sockets carried by clip plates, and provides, by a novel construction of the clip and plates, for holding the upper clip plate rigid against the under side of the axle, the lower clip plate moving on the upper clip plate to effect the proper adjustment, and thus preventing the scratching or marring of the axle, which is frequently caused where both plates have movement.

PUMP.—Dudley L. Smith and Frank E. Womer, Fairhaven, Wash. This is a pump more especially designed for raising impure water containing gravel, stones, etc., and the invention provides for a chamber connected with the pump cylinder and the suction pipe, and by a drop or downward bend with the discharge pipe, inclined hinge valves controlling the inflow and outflow to and from the chamber.

EAVES TROUGH PROTECTOR.—Marcellus M. Hitt, Luray, Va. To prevent birds from building their nests over the trough, and also keep the droppings of birds, leaves, and other trash out of the trough, this inventor has devised a protector whose body is composed of bent wire gauze having in its edges projecting rods and holders provided with hooks for attaching the protector to the trough. The protector can be adjusted to give it the same inclination as the roof.

BOOT OR SHOE HOLDING STAND.—Richard Lundqvist, Laguna de Terminos, Mexico. For conveniently cleaning, blacking, polishing, or otherwise treating a boot or shoe, this inventor has devised a stand for holding the boot or shoe in the best position. The stand comprises a suitable base on which is a post having near its middle a box for brushes, etc., and on the top of the post is a rest similar to a foot, the shoe being engaged by a last and held in position on the rest by a curved spring-pressed lever. The last does not need to fit very snugly, and the two or three sizes required may be kept in the brush box.

BATHING FORM.—Kate Hatch, Brooklyn, N. Y. For the use of ladies while bathing in the surf or other place, to protect and shield the upper front part of the body, this inventor has devised a form comprising a front made of a single piece of rubber or other flexible material, adapted to fit snugly and conform to the upper part of the wearer's body. The front has bust-supporting pockets, and at its upper end are shoulder straps adapted to hook upon rear extensions at the sides of the front. There are also side straps which pass under the wearer's arms, crossing the back, to be attached to hooks on the sides of the front, and back straps. Each of the straps is adapted to be drawn and held sufficiently tight to conveniently support the form on the wearer's body.

BEDSTEAD BRACKET.—Henry G. Traeger, Portersville, Cal. This invention provides a bracket, preferably made of cast metal, for convenient attachment to the inner corners of bed posts, on which the bracket is readily adjustable vertically, it being designed to receive one corner of the bed spring, mattress, etc., and for use in lieu of slats, dispensing with the racks commonly provided on the side pieces of bedsteads and affording a much more cleanly and desirable article of furniture.

NECK YOKE.—John B. Lockwood, Helena, Montana. This device has an eye adapted to receive the vehicle pole, there being pivoted to the eye the lower end of a clamping bar with a cam surface engaging the pole, while a sleeve receiving the yoke has lugs pivoted to the upper end of the clamping bar. The harder the pull in a forward direction on the neck yoke, the tighter the clamping bar will be engaged with the top of the pole, which is positively prevented from becoming accidentally detached and dropping to the ground.

TRAP.—Job T. Wells, Cando, North Dakota. To catch small animals or birds, this inventor has devised a bait-alluring device in which the cage has at one end a transverse passage with normally open ends, a hinged gate at each end of the passage, and spring mechanism to release the gates upon the entry of a victim.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

UNITED STATES COMMISSION OF FISH AND FISHERIES. Part XIX. Report of the Commission for the year ending June 30, 1893. Washington. 1895. 8vo, pp. 142.

ECONOMIC MINING. A practical handbook for the miner, the metallurgist, and the merchant. By C. G. Warnford Locke. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1895. Pp. 668. 8vo. 175 illustrations. Price $5.

Notwithstanding the fairly abundant mining literature, there is no room for doubt that a book founded on the lines of this volume will supply a long felt want. The reason for this is, that by the rigid exclusion of matters having only an academic or historic interest, the space is afforded for dealing with just those points which are, perhaps, not of strictly scientific value, but which have, nevertheless, a high economic importance, and go far toward determining the profitable or unprofitable result of an undertaking. As mining and metallurgy are industrial pursuits, followed with a view of financial gain, the economic aspect is quite as deserving of study as the highly controversial questions regarding the history of strata, etc. Accepting the beds and lodes and veins as accomplished facts, the book endeavors to describe in plain language and with a practical aim how these deposits will best be worked under the various conditions encountered, and how the valuable portions of their contents can most cheaply and effectively be separated and prepared as marketable commodities. This is a most excellent book, and the author has acted very wisely in excluding the old processes, which are now interesting only from an historical point of view.

AMERICAN WOODS. By Romeyn B. Hough, author and publisher. Lowville, N. Y. 1893. 8vo. Pp. 79. Illustrated, 75 samples of wood, portfolio, in cloth case. Price $5.

American Woods is a publication in book form illustrated by neatly arranged sections of wood, which have been sliced by an ingenious machine. It is issued in parts, like the above, which is Part I, each representing twenty-five species by seventy-five or more authentic and beautifully prepared specimens showing transverse, radial and tangential views of the grain. The design of this work is to show in as compact and perfect manner as possible the beauty and characteristic structure of the various timbers of our North American forests. The thin slices measure 2 by 5 inches and exhibit the grain in all aspects. They are so thin as to admit light through them. (The author also prepares lantern slides of wood, which prove very useful in teaching.) Each section is securely mounted in a cardboard frame of a purple black color, bearing the scientific or botanical name, in the English, German, French and Spanish languages. A single frame contains only the set of three sections of a single species. With these frames, which are separate, not bound together—so as to admit of being examined singly or arranged in a window—is a pamphlet of text giving full information containing the various species represented. The author has been very careful about the identification of each tree selected for the specimen; hence he can vouch for the authenticity of every specimen represented. Mr. Hough had charge of the remarkable New York State Forestry Exhibit at the Columbian Exposition. The work is also supplied in other bindings and the specimens of wood or the text may be purchased singly. The author also prepares wooden cross section cards which are a novelty. The science of botany is apt to make a very dry study, but it could easily be rendered more interesting by a collection of these woods.

ANNUAL REPORT OF THE STATE GEOLOGIST FOR THE YEAR 1894. By John C. Smock, State Geologist. Trenton, N. J. 1895. 8vo. Pp. 304. Plates, maps.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER, 1895.—(No. 121.)

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2. Plate in colors of a cottage in the Colonial style recently erected at Mount Vernon, N. Y. at a cost of $4,750. Two perspective elevations and floor plans. A picturesque design. Mr. H. J. Robinson, architect, Mount Vernon, N. Y.
3. A double house at Marietta, Ohio, recently erected at a cost of $2,163. Three perspective elevations and floor plans. William Foreman, architect, Marietta, Ohio.
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6. A Reformed Dutch Church at Warwick, N. Y. Three perspective elevations and floor plans. Cost $30,000. Architect, Mr. E. G. W. Dietrich, New York. A design successfully treated in the Byzantine style.
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11. Miscellaneous Contents: Hints to readers—The education of customers.—The echo organ at Westminster Abbey. The Mascot heater, illustrated.—Carlisle's burglar proof window sash lock, illustrated.—Steam pipe and boiler covering, illustrated.—A large shipment of roofing slate.—Moving a masonry house.—The "Royal" door check and spring, illustrated.—An improved window screen and awning, illustrated.—An improved steam heating boiler, illustrated.—Improved woodworking machinery, illustrated.—Painting iron work.—A new and powerful elevator, illustrated.—Cheap flour or middlings in paint.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(6667) X. Y. asks: 1. Where can I find the exact diameter, in parts of inch, of machine screws? A. A complete table of sizes of shank heads, threads and lengths of machine screws, American Screw Company's standard, is published in Kent's "Mechanical Engineer's Pocket Book," $5 by mail. 2. Is it advisable to grind the back of a razor as thin as that of a pocket knife in order to get an acute cutting angle? If not, why? A. It would not be desirable to have the back of the razor too thin; the back is usually all right as the razor is sold. 3. In electroplating, is gold of 24 karat necessary? Will not a lower karat answer? A. Any degree of fineness of gold may be used in plating. 4. How to make stick mucilage. A. For Pocket Mucilage.—Boil 1 pound of the best white glue and strain very clear; boil also 4 ounces of isinglass and mix the two together; place them on a water bath with half a pound of white sugar, and evaporate till the liquid is quite thick, when it is to be poured into moulds, cut and dried to carry in the pocket. This mucilage immediately dissolves in water and fastens paper very firmly. 5. Name the materials used to color wax a bright pink. A. Use vermilion.

(6668) J. P. K. says: Will you please inform me what is the receipt for tempering mill picks? A. There is nothing peculiar in hardening mill picks, only that they should be as hard as possible and moderately tough. The greatest care should be taken to avoid burning the steel. Where there is much of this work to be done, the picks can be heated in a pot of cherry red hot lead, then dipped plumb into clearwater at about 60°. Do not draw the temper. The hardening by the ordinary smith's fire can be well done if charcoal is used, and not hurried through the fire. Hurry burns the corners Much also depends upon the shape of the pick, as to whether it is a sectional or leaf pick, or a thick solid pick, the last being the most difficult to manage, on account of the sharp edge and thick back. They should be laid across the fire, so as to heat the eyes as fast as the edge.

(6669) D. C. D. says: Will you kindly inform me of a receipt for a quick-drying polish such as is used for polishing guitars, mandolins, etc.? Would like one which will give the article to be polished a hard finish not liable to scratch A. Treat the same as in the following, which are directions for violin varnishing. Dissolve over a moderate fire—

Sandarac	12 parts.
Shellac	6 "
Mastic	6 "
Elemi	3 "

In 150 parts 95 per cent alcohol which has been colored red with cochineal, or if a darker red is required, add dragon's blood gum. When the above is dissolved add 6 parts Venice turpentine. As this varnish is highly inflammable, use caution as to fire.

(6670) R. J. C. asks how to bleach straw plait. A. This is bleached by exposing it to the fumes of burning sulphur in a close chest or box, or by immersing it in a weak solution of chloride of lime, and afterward washing it well in water. Water, strongly acidulated with oil of vitriol or oxalic acid, is also used for the same purpose. Straw may be dyed with any of the simple liquid dyes.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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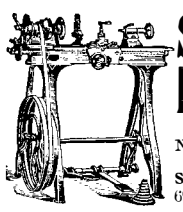

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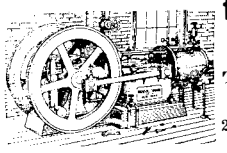
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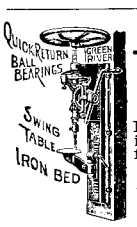

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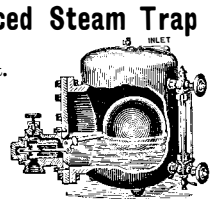

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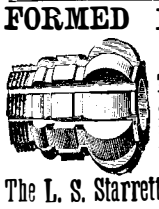
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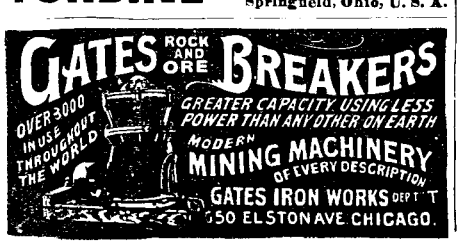
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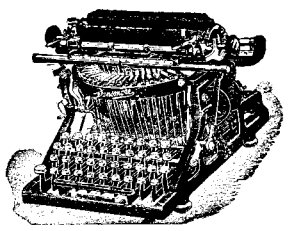

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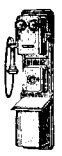

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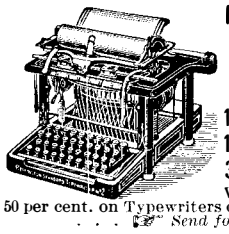

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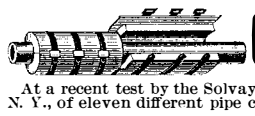
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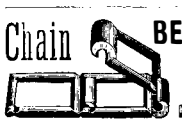
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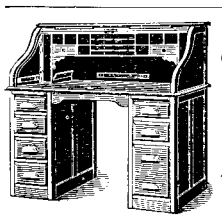
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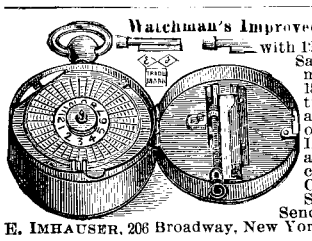
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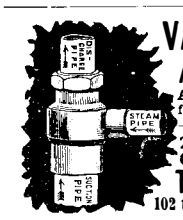

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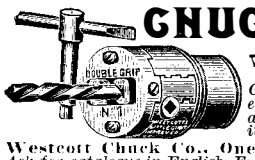

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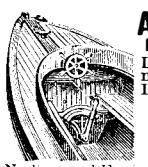
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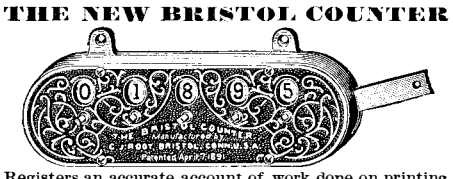

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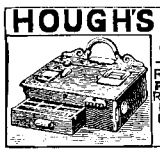
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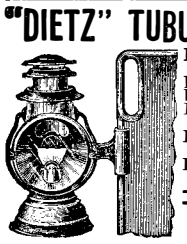
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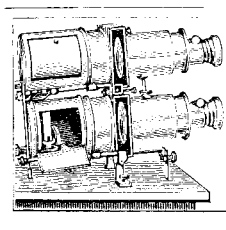
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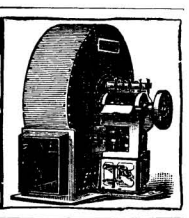

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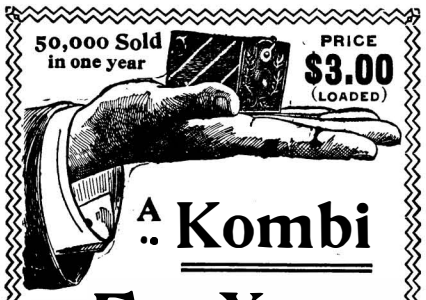

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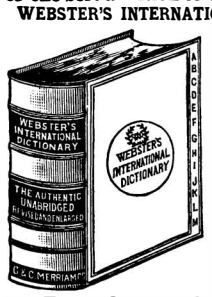

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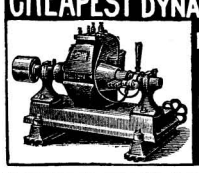

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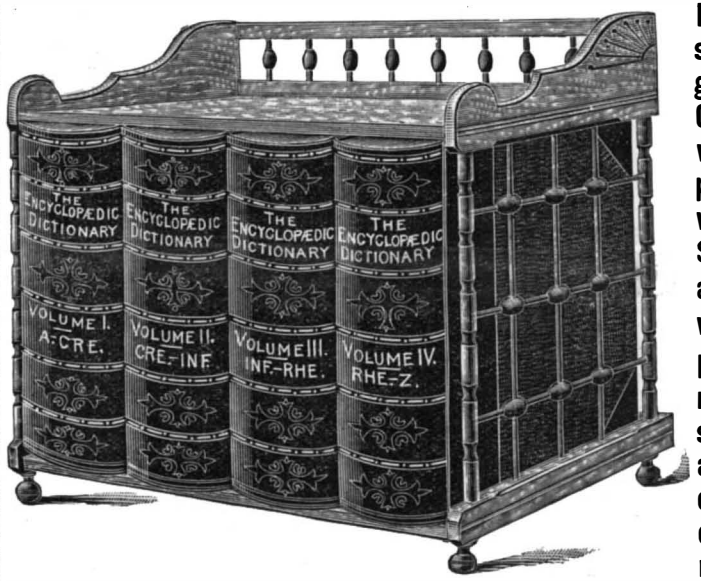

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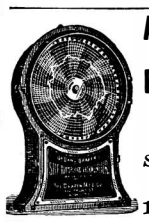

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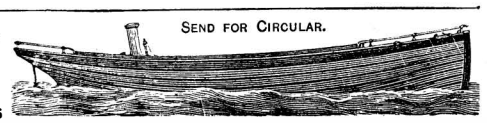

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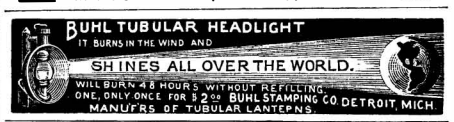
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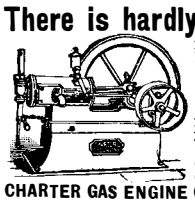

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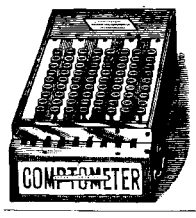

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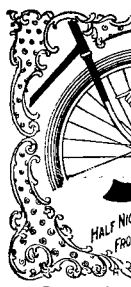

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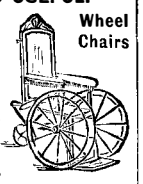

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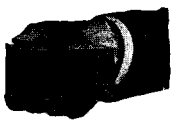

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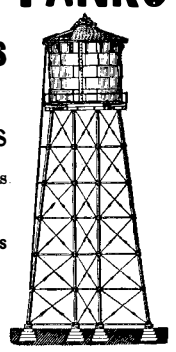

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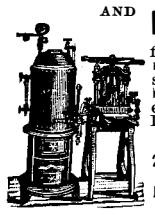

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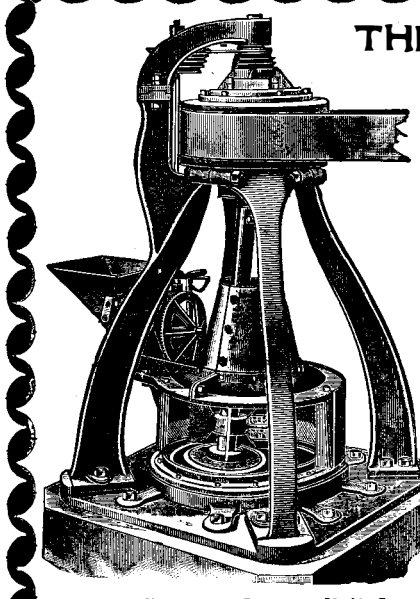

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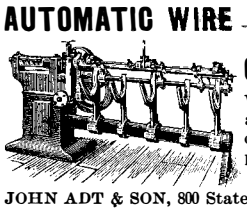

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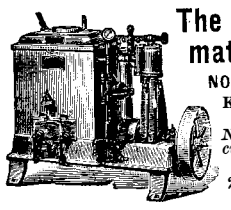

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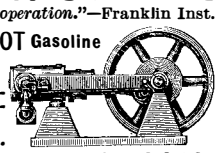

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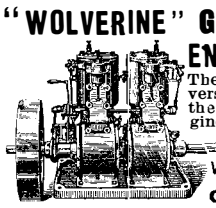

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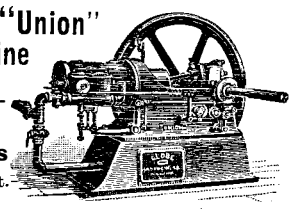

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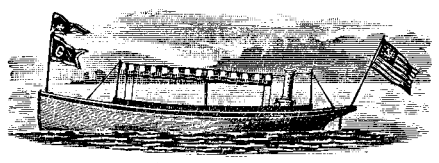

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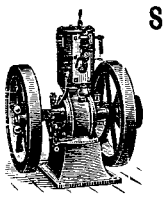

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